SOIL SURVEY OF

Howard County, Indiana

U. S. Department of Agriculture
Soil Conservation Service
In cooperation with
Purdue University
Agricultural Experiment Station

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Major fieldwork for this soil survey was done in the period 1960 to 1965. Soil names and descriptions were approved in 1965. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1966. This survey was made cooperatively by the Soil Conservation Service and the Purdue University Agricultural Experiment Station. It is part of the technical assistance furnished to the Howard County Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D. C. 20250

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Howard County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the tree and shrub group and the wildlife group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees and shrubs.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners, engineers and builders can find, under "Engineering Properties of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices, and can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Howard County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

Cover: Typical landscape in the Crosby-Brookston soil association about 3 miles west of Kokomo

CONTENTS

SOIL SURVEY OF HOWARD COUNTY, INDIANA

BY JACK M. DEAL, SOIL SCIENTIST, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH

PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

HOWARD COUNTY, in the north-central part of Indiana, has an area of 293 square miles. It extends 27 miles from east to west and 11 miles from north to south.

Figure 1.--Location of Howard County in Indiana.

The air distances from Kokomo to principal cities in Indiana are shown in figure 1. Kokomo, the county seat, is the largest city in the county. The population of Kokomo was 47,197 in 1960. Other major trading centers in the county are Greentown in the east-central part and Russiaville in the southwestern part.

The population of Howard County was 69,509 in 1960. The total rural population was 22,312. In 1964, there were 1,095 farms of all types in the county.

Approximately 80 percent of the soils in Howard County are used for farming. Most farms are used to grow cash grains and to raise hogs. The major crops are corn, soybeans, and wheat. Tomatoes also are a major crop in parts of the county.

The business and industrial enterprises in Kokomo are the main source of income for residents of the county. Many farmers work part of the year in these local industries. Although the use of soils for farming is emphasized in this survey, considerable attention also is given to nonfarm uses.

Most areas of Howard County are drained by Wildcat Creek and its tributaries. This creek flows from east to west through the center of the county.

Elevation is fairly uniform throughout the county. The Wisconsin Glacier crossed the area now occupied by Howard County. As it passed, the glacier scoured and leveled the terrain. As the glacier receded, large amounts of glacial till were deposited. This Wisconsin glacial till underlies most of the soils in the county.

The climate of Howard County is continental. The climate does not vary appreciably from place to place within the county because elevation is uniform. Weather is determined by a regular cycle of southerly and northerly winds that pass through the county bringing high-pressure and low-pressure fronts.

For more information about Howard County, refer to the section "General Nature of the County" at the back of this survey.

HOW THIS SURVEY WAS MADE

Soil scientists made this survey to learn what kinds of soils are in Howard County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The soil series and the soil phase are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Miami and Kokomo, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Miami silt loam, 2 to 6 percent slopes, eroded, is one of several phases within the Miami series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such mapping unit shown on the soil map of Howard County is the soil complex, Crosby-Miami silt loams, 2 to 6 percent slopes, eroded.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so disturbed by man that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Gravel pits is a land type in Howard County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, community planners, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

The general soil map at the back of this survey shows, in color, the soil associations in Howard County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Howard County are discussed in the following pages.

1. Blount-Pewamo Association

Deep, somewhat poorly drained and very poorly drained, medium-textured and moderately fine textured, nearly level to gently sloping soils that have a fine-textured layer in the subsoil; on uplands

This association occurs on upland till plains in the northeastern part of the county. It consists mainly of somewhat poorly drained Blount soils on flats and low ridges and very poorly drained Pewamo soils in slight depressions, swales, and narrow drainageways (see fig. 2).

This association occupies 22 percent of the county. Of this, 49 percent is Blount soils, 49 percent is Pewamo soils, and 2 percent is minor soils.

Blount soils have a surface layer that is 6 to 10 inches thick over a mottled, grayish-brown and yellowish-brown, fine-textured or moderately fine textured subsoil. Limy, moderately fine textured glacial till is at a depth of 30 to 44 inches.

Pewamo soils have a surface layer 10 to 14 inches thick over a gray, fine-textured or moderately fine textured subsoil that is mottled with yellowish brown. Brown, calcareous, moderately fine textured glacial till is at a depth of 39 to 60 inches.

The most extensive of the minor soils are well-drained Morley soils on low knolls, on breaks, and along the terminal moraine. Small areas of Carlisle muck and Linwood muck occur in deep depressions throughout the association.

The soils of this association are used mostly for crops. Small areas are used for pasture or are in trees. Growing cash grain and raising hogs are the major farm enterprises. Corn, soybeans, and tomatoes are the principal crops. Some areas are used for dairy farming, for raising feeder cattle, and for general farming.

Wetness is the major limitation of the soils in this association. Management for crops should include artificial drainage by open ditches, surface drains, and tile. Lime generally is not needed on Pewamo soils, but it is needed on Blount soils. Crops on both kinds of soil respond well to heavy applications of fertilizer.

The city of Greentown is in this association. A seasonal high water table and ponding are the major limitations to community development.

2. Crosby-Brookston Association

Deep, somewhat poorly drained and very poorly drained, medium-textured and moderately fine textured, nearly level and gently sloping soils; on uplands

This association occurs on upland till plains in the north-central and southern parts of the county (see fig. 2). It consists mainly of somewhat poorly drained Crosby soils on flats and low ridges and very poorly drained Brookston soils in slight depressions, swales, and narrow drainageways.

This association occupies 35 percent of the county. Of this, 49 percent is Crosby soils, 47 percent is Brookston soils, and 4 percent is minor soils.

Crosby soils have a surface layer that is 7 to 11 inches thick over a gray, moderately fine textured subsoil mottled with yellowish brown. At a depth of 26 to 41 inches, the subsoil is underlain by limy, medium-textured glacial till.

Brookston soils have a surface layer that is 10 to 14 inches thick over a mottled, dark-gray, moderately fine textured subsoil. At a depth of 32 to 60 inches, the subsoil is underlain by brown, calcareous, glacial till.

Among the minor soils are well-drained Miami soils on knolls, on breaks, and along drainageways, and Carlisle muck and Linwood muck in the low depressions northeast of Kokomo.

The soils of this association are used mainly for crops. Small areas are in pasture or woodlots. Growing cash grain and raising hogs are the major farm enterprises. Some farms raise feeder cattle or practice general farming. The main crops are corn and soybeans. Small grains are also grown, and tomatoes are an important specialty crop.

Wetness is the major limitation of the soils in this association. Management for crops should include artificial drainage by open ditches, tile, and surface drains. Crops respond well to heavy applications of fertilizer. Lime generally is not needed on Brookston soils. Crosby soils require

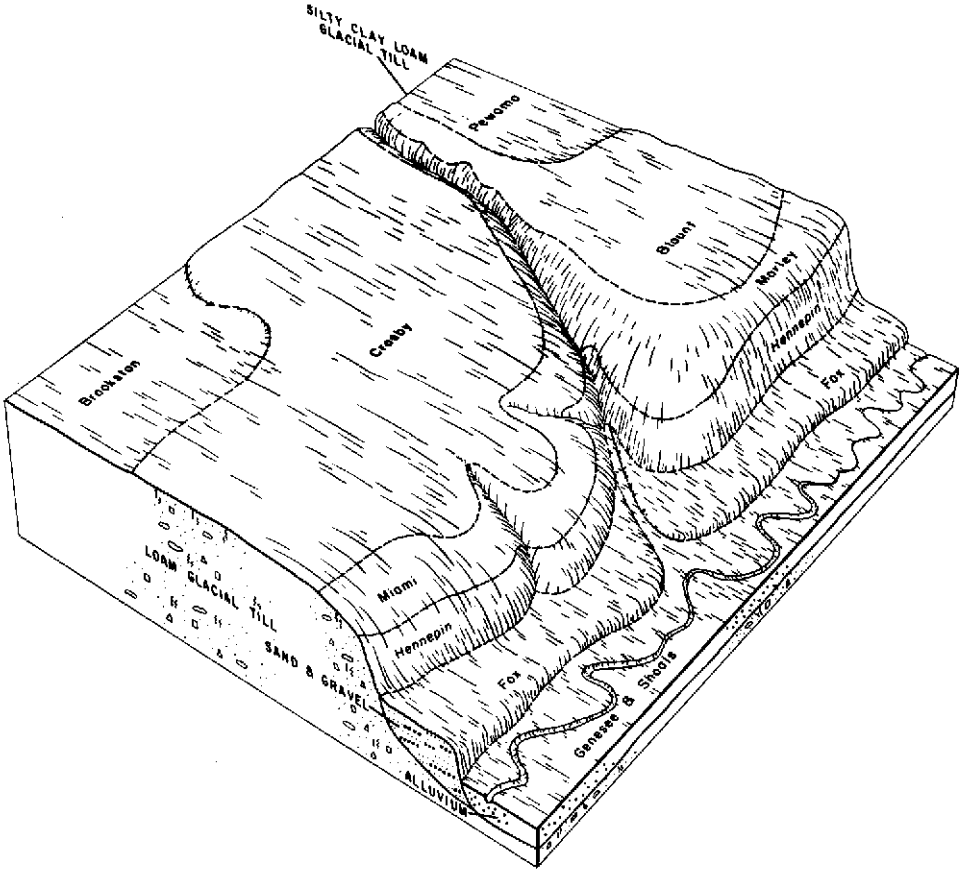


Figure 2. -- Pattern of soil associations in the eastern part of Howard County.

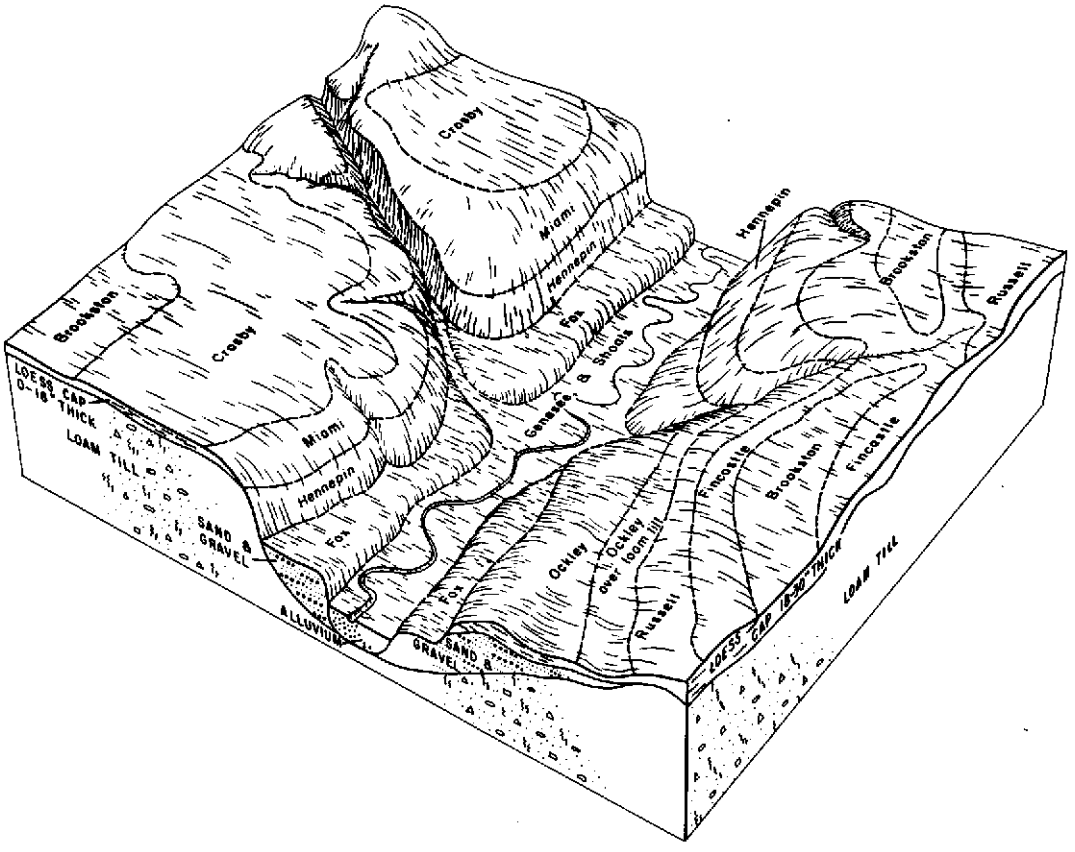


Figure 3. -- Pattern of soil associations in the western part of Howard County.

lime and contain little available phosphate and potash.

A large part of the city of Kokomo is in this association. A seasonal high water table and ponding are the major limitations to community development.

3. Fincastle-Brookston Association

Deep, somewhat poorly drained and very poorly drained, medium-textured and moderately fine textured, nearly level soils; on uplands

This association occurs on upland till plains in the northwestern and southwestern parts of the county. It consists mainly of somewhat poorly drained Fincastle soils on flats and low ridges and very poorly drained Brookston soils in slight depressions, swales, and narrow drainageways (see fig. 3).

This association occupies 22 percent of the county. Of this, 53 percent is Fincastle soils, 42 percent is Brookston soils, and 5 percent is minor soils.

Fincastle soils have a surface layer that is 8 to 11 inches thick over a mottled, gray and yellowish-brown, moderately fine textured subsoil. At a depth of 42 to 58 inches, the subsoil is underlain by limy, loam glacial till.

Brookston soils have a surface layer that is 10 to 14 inches thick over a mottled, dark-gray, moderately fine textured subsoil. At a depth of 38 to 60 inches, the subsoil is underlain by brown, calcareous, loam glacial till.

Among the minor soils are Kokomo soils, Carlisle muck, and Linwood muck that occur in areas 2 to 10 acres in size scattered rather uniformly throughout the association. Small areas of well-drained Miami and Russell soils are on knolls and along drainageways.

The soils of this association are used mostly for crops. Small areas are used for pasture or woodland. Growing cash grains and raising hogs are the major farm enterprises. Some farms are used for raising beef cattle or for general farming. The major crops are corn and soybeans, but small grains are also grown.

Wetness is the major limitation of the soils in this association. Management for crops should include artificial drainage by open ditches, tile, and surface drains. Crop response to heavy applications of fertilizer is good. Lime generally is not needed on Brookston soils, but it is needed on Fincastle soils.

The town and country area northwest of Kokomo is in this association. A seasonal high water table and ponding are the major limitations to community development.

4. Miami-Russell-Morley Association

Deep, well-drained, medium-textured and moderately fine textured, gently sloping to strongly sloping soils; on uplands

This association occurs on upland till plains adjacent to the flood plain of Wildcat Creek and its tributaries. It occupies 16 percent of the county. Of this, 54 percent is Miami soils, 28 percent is Russell soils, 10 percent is Morley soils, and 8 percent is minor soils.

Miami soils have a medium-textured surface layer that is 4 to 9 inches thick over a dark yellowish-brown, moderately fine textured subsoil. At a depth of 22 to 30 inches, the subsoil is underlain by gray, calcareous, medium-textured glacial till.

Russell soils have a medium-textured surface layer that is 4 to 9 inches thick over a dark yellowish-brown, moderately fine textured subsoil. The upper part of the soil developed from loess and the lower part developed from medium-textured till. At a depth of 42 to 65 inches, the subsoil is underlain by gray, calcareous, medium-textured till.

Morley soils occur mainly south and east of Greentown. They have a medium-textured surface layer that is 4 to 9 inches thick over a dark yellowish-brown, moderately fine textured subsoil. At a depth of 22 to 40 inches, the subsoil is underlain by moderately fine textured glacial till.

Among the minor soils are well-drained Ockley and Fox soils on the outwash terrace benches and well-drained Hennepin soils on steep breaks where streams intersect.

The soils in this association are used mostly for crops. Crops respond well to good management. General farming is common. Corn and soybeans are the major crops on gently sloping soils. Moderately sloping and strongly sloping soils are used for small grains and permanent pasture.

Runoff and erosion are the major hazards to use and management of the soils in this association. Near Kokomo and Greentown the soils are used for housing. Limitations to community development are few.

5. Genesee-Shoals Association

Deep, well-drained and somewhat poorly drained, medium-textured, nearly level soils; on alluvial bottoms

This association occurs on first bottoms and stream terraces adjacent to Wildcat, Kokomo, Little Wildcat, Honey, and Deer Creeks (see fig. 3). It consists mainly of well-drained Genesee soils on slightly elevated flats on the larger flood plains and somewhat poorly drained Shoals soils on narrow bottoms and in slight depressions in the larger bottoms.

This association occupies 5 percent of the county. Of this, 47 percent is Genesee soils, 41 percent is Shoals soils, and 12 percent is minor soils.

Genesee soils have a surface layer that is 8 to 12 inches thick over friable, dark yellowish-brown alluvial material.

Shoals soils have a grayish-brown surface layer that is 9 to 12 inches thick over mottled, light brownish-gray to gray alluvial material.

Among the minor soils are well-drained Fox soils on low terrace benches, very poorly drained Patton soils in depressions on the flood plains, and steep and very steep Hennepin soils where streams intersect.

Most of this association is used for crops, mainly corn. Part of it is used for pasture and woodland.

Flooding is the main hazard to use and management of these soils. Floods generally occur early in spring before planting, but occasionally crops are damaged by floods in June or July.

Near Kokomo the soils of this association are used for parks and playgrounds.

DESCRIPTIONS OF THE SOILS

This section describes the soil series and single soils, or mapping units, of Howard County. The approximate acreage and proportionate extent of each mapping unit are given in table 1.

The procedure of this section is first to describe the soil series, and then the mapping units of that series. Thus, to get full information about any one mapping unit it is necessary to read the description of that unit and also the description of the soil series to which it belongs.

The soil series contains a brief nontechnical description of a soil profile, the major layers from the surface downward. Colors given in the profile are for moist soil materials. The profile is considered representative of all the soils in the series. If the profile for a given mapping unit differs from this representative profile, the differences are stated in the descriptions of the unit, unless they are given in the name of the mapping unit. Also described for the series is a detailed profile representative of the series. This profile is included for soil scientists, engineers, and others who need to make highly technical interpretation of the soils.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Gravel pits, Made land, and Quarries are miscellaneous land types and do not belong to a soil series; nevertheless, they are listed in alphabetic order along with the soil series.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. At the end of each soil description, a symbol in parentheses identifies the capability unit in which the soil has been placed. The page on which each capability unit is described can be found by referring to the "Guide to Mapping Units" at the back of this soil survey.

Soil scientists, engineers, students, and others who want more information about the soils should turn to the section "Formation and Classification of Soils." Many terms used in the soil descriptions and other sections of the survey are defined in the Glossary and in the "Soil Survey Manual (6)." 1/

1/ Underlined numbers in parentheses refer to Literature Cited, p. 61.

TABLE 1.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF SOILS MAPPED

Soil	Area	Extent	Soil	Area	Extent
	Acres	Percent		Acres	Percent
Blount silt loam, 0 to 2 percent slopes	19,655	10.5	Fox silt loam, 2 to 6 percent slopes, eroded	262	0.1
Blount silt loam, 2 to 4 percent slopes, eroded	1,222	.7	Fox soils, 6 to 12 percent slopes, severely eroded	437	.2
Brookston silty clay loam	49,587	26.4	Genesee silt loam	4,040	2.2
Carlisle muck	504	.3	Gravel pits	264	.1
Crosby silt loam, 0 to 2 percent slopes	33,887	18.1	Hennepin loam, 25 to 60 percent slopes	1,717	.9
Crosby silt loam, 2 to 4 percent slopes, eroded	658	.4	Kokomo silty clay loam	871	.5
Crosby-Miami silt loams, 2 to 6 percent slopes, eroded	524	.3	Kokomo silt loam, overwash	197	.1
Fincastle silt loam	22,947	12.2	Linwood muck	215	.1
Fox silt loam, 0 to 2 percent slopes	216	.1	Made land	88	(1/)
			Miami silt loam, 2 to 6 percent slopes, eroded	6,881	3.7
			Miami silt loam, 6 to 12 percent slopes, eroded	911	.5

TABLE 1.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS MAPPED--Continued

Soil	Area	Extent	Soil	Area	Extent
	Acres	Percent		Acres	Percent
Miami clay loam, 2 to 6 percent slopes, severely eroded	433	0.2	Ockley silt loam, loamy substratum, 0 to 2 percent slopes	669	0.4
Miami clay loam, 6 to 12 percent slopes, severely eroded	3,362	1.8	Ockley silt loam, loamy substratum, 2 to 6 percent slopes, eroded	883	.5
Miami clay loam, 12 to 18 percent slopes, severely eroded	490	.3	Patton silty clay loam, loamy substratum	875	.5
Morley silt loam, 2 to 6 percent slopes, eroded	1,216	.6	Patton silty clay loam, occasionally flooded	257	.1
Morley silty clay loam, 2 to 6 percent slopes, severely eroded	199	.1	Pewamo silty clay loam	20,845	11.1
Morley silty clay loam, 6 to 12 percent slopes, severely eroded	521	.3	Quarries	172	.1
Ockley silt loam, 0 to 2 percent slopes	1,087	.6	Russell silt loam, 0 to 2 percent slopes	3,097	1.6
Ockley silt loam, 2 to 6 percent slopes, eroded	965	.5	Russell silt loam, 2 to 6 percent slopes, eroded	3,046	1.6
			Shoals silt loam	3,634	1.9
			Water	686	.4
			Total	187,520	100.0

1/ Less than 0.1 percent.

Blount Series

The Blount series consists of deep, somewhat poorly drained, nearly level and gently sloping soils. These soils formed in silty clay loam glacial till on uplands.

The surface layer is dark grayish-brown silt loam about 7 inches thick.

The subsoil is about 25 inches thick. The upper part is medium acid, brown silty clay that is mottled with grayish brown. The middle part is medium acid, brown silty clay loam that is mottled with grayish brown and yellowish brown. The lower part is neutral, yellowish-brown silty clay loam that is mottled with grayish brown.

The underlying material is olive-brown silty clay loam glacial till that is streaked with light gray.

Blount soils are moderate in organic-matter content. The plow layer is medium acid unless it has been limed. Crops on these soils respond well to additions of lime and a complete fertilizer. The available water capacity is high, and the permeability is slow. Tile drainage is needed for crops.

Where adequately drained and fertilized, Blount soils are suited to all crops commonly grown in the county. Most areas are intensively cultivated. The main crops are corn and soybeans, but small grains and legume-grass hay are also grown. Woodlots, 2 to 10 acres in size, are in some areas.

Representative profile of Blount silt loam, 0 to 2 percent slopes, 300 feet north and 40 feet east of SW. corner, SE1/4 sec. 14, T. 24 N., R. 5 E., in a cultivated field:

Ap--0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable when moist; many medium and fine roots; slightly acid; abrupt, smooth boundary.

B21tg--7 to 10 inches, dark grayish-brown (10YR 4/2) silty clay loam that has common, fine, faint mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/6); moderate, medium, subangular blocky structure; firm when moist; coatings of gray (10YR 6/1) silt on ped faces; medium acid; clear, smooth boundary.

B22tg--10 to 16 inches, brown (10YR 5/3) silty clay that has common, fine, faint mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/6); strong, medium, angular blocky structure; firm when moist; medium films of dark-gray (10YR 4/1) clay on ped faces; fine roots along cleavage planes; some root and worm holes that are filled with dark grayish-brown (10YR 4/2) silt loam; soft, black and brown nodules of iron and manganese; medium acid; clear, smooth boundary.

B23tg--16 to 24 inches, brown (10YR 5/3) silty clay loam that has common, fine, faint mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/6); moderate, medium and coarse, angular blocky structure; firm when moist; medium films of dark grayish-brown (10YR 4/2) clay on ped faces; fine roots along cleavage planes; root and worm channels that are filled with dark grayish-brown (10YR 4/2) silt loam; soft, black and brown nodules of

iron and manganese; medium acid; clear, wavy boundary.

B3tg--24 to 32 inches, yellowish-brown (10YR 5/6) light silty clay loam that has many, coarse, faint mottles of grayish brown (10YR 5/2); weak, coarse, subangular blocky structure; firm when moist; medium films of dark-gray (10YR 4/1) clay on ped faces; fine roots along cleavage planes; some root and worm holes that are filled with dark grayish-brown (10YR 4/2) silt loam; neutral; clear, wavy boundary.

C--32 to 60 inches, olive-brown (2.5Y 4/4) silty clay loam till that is streaked with light-gray (10YR 6/1) lime along cleavage planes; weak, coarse to very coarse, angular blocky structure; firm when moist; calcareous.

In areas where Blount soils grade to Pewamo soils, the Ap horizon contains slightly more organic matter. The Ap horizon ranges from 6 to 10 inches in thickness. Depth to mottling ranges from 7 to 12 inches. The B horizon is silty clay loam, silty clay, or clay loam and ranges from 20 to 32 inches in thickness. The C horizon is silty clay loam or clay loam and ranges from olive brown to yellowish brown.

Blount silt loam, 0 to 2 percent slopes (BmA).--This soil has the profile described as representative of the series. It occurs in irregularly shaped areas less than 60 acres in size. Runoff is very slow, and erosion is a slight hazard. This Blount soil occupies slight rises that are surrounded by Pewamo soils.

Included in mapping are small areas of Blount silt loam, 2 to 4 percent slopes, eroded, and areas of Pewamo silty clay loam. Also included in the city of Greentown are large areas formerly covered by this soil that have been so mixed or disturbed by community development that it is not possible to identify the soils.

Where adequately drained, this soil is suited to all of the crops commonly grown in the county. Cultivation can be intensive. Wetness is the major hazard. (Capability unit IIw-2)

Blount silt loam, 2 to 4 percent slopes, eroded (BmB2).--The profile of this soil is similar to that described as representative of the series except that the plow layer consists of dark grayish-brown material of the original surface soil mixed with a moderate amount of moderately fine textured brown subsoil material. This soil occupies relatively narrow strips between poorly drained Pewamo silty clay loam in depressions and Blount silt loam, 0 to 2 percent slopes. It also occupies areas at the head of and along drainageways. Included in mapping are small areas of Blount silt loam, 0 to 2 percent slopes, Pewamo silty clay loam, and Morley silt loam, 2 to 6 percent slopes, eroded.

Because it occurs in small, irregularly shaped areas, this soil is generally managed the same way as the surrounding soils. Limitations for crops are moderate. Management is required to reduce wetness, maintain tilth, and reduce erosion. (Capability unit IIe-12)

Brookston Series

The Brookston series consists of deep, very poorly drained soils that occupy slight depressions in the upland till plains. These soils formed under swamp grass, water-tolerant shrubs, and hardwood trees.

The surface layer is neutral, very dark gray silty clay loam about 14 inches thick. The lower 6 inches is mottled with dark gray and dark yellowish brown.

The subsoil is neutral and about 32 inches thick. The upper part is dark-gray and gray silty clay loam that has common yellowish-brown mottles. The middle part is gray clay loam that has many yellowish-brown mottles. The lower part is mottled, yellowish-brown clay loam.

The underlying material is brown calcareous loam till mottled with dark yellowish brown. It is friable.

Brookston soils are high in organic-matter content. These soils are neutral, and crops on them respond well to a complete fertilizer. The available water capacity is high, and the permeability is slow. The water table is seasonally high, and artificial drainage is needed to insure good crop growth. If the soils are plowed when wet, large clods form that are difficult to break down into a seedbed.

Most areas of Brookston soils are intensively cultivated. Corn and soybeans are the main crops, but small grains and legume-grass hay are also grown. Woodlots 2 to 10 acres in size are in some areas of undrained soils.

Representative profile of Brookston silty clay loam, 516 feet east of county road and 345 feet south of open drainage ditch, SW1/4 sec. 5, T. 23 N., R. 4 E., in a cultivated field:

Ap--0 to 8 inches, very dark gray (10YR 3/1) light silty clay loam; weak, coarse, granular structure; firm when moist, cloddy when dry; abundant fine roots; neutral; abrupt, smooth boundary.

A12--8 to 14 inches, very dark gray (10YR 3/1) silty clay loam; common, fine, faint mottles of dark yellowish brown (10YR 4/4) and dark gray (10YR 4/1); weak, coarse, subangular blocky structure that breaks to moderate, medium, granular; firm when moist; abundant, fine roots; neutral; clear, wavy boundary.

B1tg--14 to 20 inches, dark-gray (10YR 4/1) silty clay loam that has common, fine, faint mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6); moderate, medium and coarse, subangular blocky structure; firm when moist; thin, discontinuous films of very dark gray (10YR 3/1) and gray (10YR

5/1) clay on ped faces; few, fine roots; neutral; clear, wavy boundary.

IIB21tg--20 to 31 inches, gray (N 5/0) silty clay loam that has common, fine, distinct mottles of dark brown (10YR 4/3) and yellowish brown (10YR 5/4); moderate, medium, subangular blocky structure; firm when moist; glacial pebbles 2 to 5 millimeters in diameter; root channels that are filled with very dark grayish brown (10YR 3/2) silty clay loam; old crayfish channels that are filled with very dark brown (10YR 2/2) silty clay loam material; thin, discontinuous films of gray (10YR 5/1) clay on ped faces; neutral; gradual, wavy boundary.

IIB22tg--31 to 40 inches, gray (10YR 5/1) clay loam that has many, medium, distinct mottles of yellowish brown (10YR 5/4 and 5/8) and dark yellowish brown (10YR 4/4); moderate, coarse, subangular blocky structure; firm when moist; thin, discontinuous films of very dark gray (10YR 3/1) clay on a few ped faces; few, fine roots in upper part; numerous glacial pebbles; neutral; clear, irregular boundary.

IIB3--40 to 46 inches, yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) clay loam that has common, medium and coarse, distinct mottles of gray (10YR 5/1); weak, coarse, subangular blocky structure; firm when moist; small irregularly shaped pockets of loamy material; few, thin, discontinuous films of gray (10YR 5/1) clay along cleavage planes; numerous glacial pebbles; neutral; clear, irregular boundary.

IIC--46 to 66 inches, brown (10YR 5/3) loam till; massive; friable when moist; thin films of dark yellowish-brown (10YR 4/4) and brown (7.5YR 5/4) clay along cleavage planes; finger-like channels of gray (10YR 5/1) silty clay loam that have thick films of very dark gray (10YR 3/1) clay on the channel walls; calcareous.

In areas where Brookston soils grade to Crosby or Fincastle soils the surface layer contains less organic matter. The combined thickness of the Ap and A12 horizons ranges from 10 to 16 inches. The Ap and A12 horizons are black, very dark gray, or very dark brown. The B horizon ranges from 30 to about 50 inches in thickness, and is gray, dark gray, or olive gray. The IIB21tg horizon commonly contains enough sand to make it feel gritty.

Brookston silty clay loam (0 to 2 percent slopes) (Bs).--This soil occurs in depressions, swales, and narrow drainageways. Runoff is very slow or ponded. Areas of this soil are irregular in shape and more than 60 acres in size.

Included in mapping are some large areas where a few inches of silt or sand and gravel are above the calcareous till. Also included are small areas of Crosby silt loam, 0 to 2 percent slopes, Fincastle silt loam, and Kokomo silty clay loam.

Where drained, this soil is well suited to corn and soybeans. Wetness is the main hazard. (Capability unit IIw-1).

Carlisle Series

The Carlisle series consists of deep, very poorly drained muck that formed in thick deposits of organic material. The muck occurs in nearly circular areas 2 to 90 acres in size that are in swales and deep depressions.

The surface layer is about 20 inches thick. The upper 9 inches is neutral, black, and friable. The lower 11 inches is slightly acid and very dark grayish brown.

The underlying material is slightly acid, dark grayish-brown muck. It contains a variable amount of undecomposed leaves, grass, stems, and small woody twigs.

Carlisle muck is very high in organic-matter content. The available water capacity is high. The water table is seasonally high, and artificial drainage is needed to insure good growth of crops.

Most areas of Carlisle muck are used for pasture or as habitat for wetland wildlife. Where adequately drained, Carlisle muck is easy to cultivate and is well suited to corn and vegetables.

Representative profile of Carlisle muck, 223 feet south and 105 feet east of NW. corner, SW1/4 sec. 29, T. 24 N., R. 4 E., in a cultivated field:

1--0 to 9 inches, black (N 2/0) muck; weak, fine, granular structure; friable when moist; neutral; clear, smooth boundary.

2--9 to 20 inches, very dark grayish brown (10YR 3/2) muck; weak, very coarse, granular structure; friable when moist; slightly acid; gradual, wavy boundary.

3--20 to 60 inches, dark grayish-brown (10YR 4/2) muck; massive; contains some undecomposed fibrous materials and woody stems; slightly acid.

The first layer is black or very dark brown. Where present, the underlying peat is very dark brown, dark yellowish brown, very dark gray, or olive gray. In the large areas of Carlisle muck little material is decomposed below a depth of 12 inches. In small areas nearly all the material is decomposed to a depth of 42 inches.

Carlisle muck (0 to 2 percent slopes) (Ca).--Carlisle muck occurs in swales and deep depressions. Runoff is very slow or ponded, and wetness is the main hazard. Included in mapping are two areas of very strongly acid, undecomposed peat 30 acres in size (sec. 22, T. 24 N., R. 4 E.). These areas are in depressions and have a cover of water-tolerant grasses and shrubs. Also included are small areas of Brookston and Kokomo silty clay loam soils.

Where fertilized and adequately drained, Carlisle muck is well suited to corn and vegetables. Soil

blowing is a hazard where the muck has been drained. (Capability unit IIIw-8)

Crosby Series

The Crosby series consists of deep, somewhat poorly drained soils that occur on uplands and are nearly level to gently sloping. These soils formed in thin deposits of loess and in underlying glacial till.

The surface layer is neutral, dark-gray silt loam about 10 inches thick.

The subsoil, about 31 inches thick, is strongly acid. The upper part is grayish-brown silty clay loam mottled with dark yellowish brown. The middle part is dark grayish-brown to dark yellowish-brown silty clay loam that has many grayish-brown and yellowish-brown mottles. It contains enough sand to make it feel gritty. The lower part is mottled yellowish-brown clay loam.

The underlying material is grayish-brown, calcareous loam glacial till. It is friable.

Crosby soils are moderate in organic-matter content. The plow layer is medium acid unless it has been limed. Crops on these soils respond well to additions of lime and a complete fertilizer. The water table is high in spring, and tile drains are needed to insure good crop growth. The available water capacity is high, and the permeability is slow.

Most areas of Crosby soils are intensively cultivated, but a few areas are in permanent pasture and small woodlots. If adequately drained and fertilized, these soils are suited to all crops commonly grown in the county.

Representative profile of Crosby silt loam, 0 to 2 percent slopes, 216 feet west and 99 feet south of NE. corner, SE1/4 sec. 24, N., T. 23 N., R. 4 E., in a cultivated field:

Ap--0 to 10 inches, dark-gray (10YR 4/1) silt loam; weak, medium, granular structure; friable when moist; few, round, soft concretions of iron and manganese 1 millimeter in diameter; common, small, irregularly shaped patches of light-gray (10YR 7/1) silt; abundant, fine roots; neutral; abrupt, smooth boundary.

B21t--10 to 15 inches, grayish-brown (10YR 5/2) silty clay loam that has many, fine, distinct mottles of yellowish-brown (10YR 5/6) and dark yellowish brown (10YR 4/4); moderate, fine, subangular blocky structure; firm when moist; discontinuous coatings of light brownish-gray (10YR 6/2) silt on ped faces; few, fine roots; strongly acid; clear, wavy boundary.

IIB22t--15 to 20 inches, dark yellowish-brown (10YR 4/4) silty clay loam that has many, medium, distinct mottles of yellowish brown (10YR 5/6) and grayish brown (10YR 5/2); moderate, medium, subangular blocky structure; firm when moist; thin films of dark-gray (10YR 4/1) clay on ped faces; few, fine roots that penetrate peds and many that are along ped faces; worm and root channels filled with dark-brown (10YR 3/3) silt; strongly acid; clear, wavy boundary.

IIB23tg--20 to 31 inches, dark grayish-brown (10YR 4/2) silty clay loam that has many, medium, distinct mottles of yellowish brown (10YR 5/6) and light yellowish brown (10YR 6/4); moderate, medium and coarse, subangular blocky structure; firm when moist; films of dark-gray (10YR 4/1) clay on most ped faces; common, soft concretions of iron and manganese; many, fine root channels filled with very dark brown (10YR 2/2) soil material; few, fine roots along ped faces; few glacial pebbles 1 millimeter to 3 inches in diameter; strongly acid in upper part to neutral in lower part; clear, wavy boundary.

IIB3--31 to 41 inches, yellowish-brown (10YR 5/8) clay loam that has common, medium, distinct mottles of grayish brown (10YR 5/2) and light yellowish brown (10YR 6/4); weak, coarse, subangular blocky structure; firm when moist; thin, discontinuous films of dark-gray (10YR 4/1) clay on ped faces; few, round pockets of light-gray (10YR 7/1) silt 1 inch to 2 inches in diameter; many glacial pebbles 5 to 15 millimeters in diameter; few, hard, yellowish-red (5YR 4/6) concretions of iron; neutral in upper part to mildly alkaline in lower part; clear, wavy boundary.

IIC--41 to 60 inches, grayish-brown (10YR 5/2) loam till streaked with gray (N 5/0) secondary lime; massive; friable when moist; several soft, round aggregates of red (2.5Y 4/8) and black (10YR 2/1); many glacial pebbles 1/2 to 1 inch in diameter; calcareous.

Where Crosby soils grade to the Fincastle soils, the loess mantle is almost 18 inches thick. Depth to mottling ranges from 8 to about 12 inches. The B2 horizons range from 18 to about 30 inches in thickness. The IIB22t and IIB23t horizons commonly contain enough sand to make them feel gritty.

Crosby silt loam, 0 to 2 percent slopes (CsA).--This soil has the profile described as representative of the series. It occupies irregularly shaped rises within areas of the depressional Brookston soils. Soil areas range from 2 to 100 acres in size. Runoff is very slow.

Included with this soil in mapping are small areas of Brookston silty clay loam, and some areas of Fincastle silt loam, where this Crosby soil grades to the Fincastle soil. Also included, in the southeast corner of the county, are soils that have a darker colored surface layer than described. In some areas a few inches of sand and gravel are above the glacial till. Included in the city of Kokomo are large areas formerly covered by this soil that have been so mixed or disturbed by community development that the soils cannot be identified.

If drained, the soil is suited to all crops commonly grown in the county. The main crops are corn and soybeans, but small grains, tomatoes, and grass-legume hay are also grown. Small areas are woodlots. Wetness is the main hazard. (Capability unit IIw-2)

Crosby silt loam, 2 to 4 percent slopes, eroded (CsB2).--This soil has medium runoff. Its profile is similar to that described as representative of the series except that the plow layer consists of the dark-gray original surface soil mixed with some of the moderately fine textured, grayish-brown subsoil. This soil occupies narrow strips between poorly drained Brookston silty clay loam and Crosby silt loam, 0 to 2 percent slopes. It also occupies areas at the head of and along drainageways.

Included with this soil in mapping are small areas of Crosby silt loam, 0 to 2 percent slopes, and Brookston silty clay loam.

This soil is generally farmed and managed the same way as surrounding soils because it is in small irregularly shaped areas. It is used for crops, mainly corn and soybeans. Limitations to use for crops are moderate. Management is needed to control erosion, dispose of excess water, and maintain tilth. (Capability unit IIe-12)

Crosby-Miami silt loams, 2 to 6 percent slopes, eroded (CyB2).--This mapping unit consists of somewhat poorly drained Crosby silt loam and well-drained Miami silt loam, both of which formed in glacial till on uplands. The native vegetation was mixed hardwoods.

These soils occupy small knolls on broad flats. They also occupy long, narrow strips adjacent to poorly drained Brookston silty clay loam on divides near the head of drainageways. The unit is 60 to 70 percent Crosby silt loam, 2 to 4 percent slopes, eroded, and 30 to 40 percent Miami silt loam, 2 to 6 percent slopes, eroded. These soils are in areas too small to map separately.

The plow layer of the soils in this unit consists of the original surface soil mixed with some of the grayish-brown or yellowish-brown, moderately fine textured subsoil. The Crosby soils occupy the lower half of the slopes and encircle the knolls. They also are on top of the larger knolls where they are nearly level. The Miami soils occupy high points on the knolls or occur as narrow bands near the top of the slopes. The knolls are surrounded by broad areas of Crosby silt loam, 0 to 2 percent slopes, and Brookston silty clay loam.

Included with these soils in mapping are small areas of Crosby silt loam, 0 to 2 percent slopes, and of Brookston silty clay loam. Also included are soils that have grayish-brown mottles in the lower half of the subsoil.

The soils in this mapping unit have medium runoff. The available water capacity is high in both soils. The permeability is slow in the Crosby soil and moderate in the Miami soil.

The soils in this unit are generally farmed the same way as the surrounding soils because they are in such small, irregularly shaped areas. Limitations to use for crops are moderate. Management is needed to control erosion and to dispose of excess water. (Capability unit IIe-12)

Fincastle Series

The Fincastle series consists of deep, somewhat poorly drained, nearly level soils on upland till plains. These soils formed in loess that ranges from 18 to 40 inches in thickness and in the underlying glacial till (pl. I).

The surface layer is neutral, dark grayish-brown silt loam about 10 inches thick.

The subsoil is medium acid and is about 44 inches thick. The upper part is mainly dark grayish-brown silty clay loam mottled with pale brown and yellowish brown. The lower part is dark-gray and light olive-brown clay loam mottled with gray and brown.

The underlying material is calcareous loam glacial till that has grayish-brown mottles. It is friable.

Fincastle soils are moderate in organic-matter content. The plow layer is medium acid unless it has been limed. These soils have a seasonally high water table, and tile drains are needed to insure good crop growth. The available water capacity is high, and the permeability is slow.

Most areas of Fincastle soils are intensively cultivated. A few areas are small woodlots. Where adequately drained and fertilized, these soils are suited to all crops commonly grown in the county.

Representative profile of Fincastle silt loam in SE. corner, SW1/4 sec. 18, T. 24 N., R. 3 E., 1,015 feet east and 75 feet north of county roads 600W and 300N, in a cultivated field:

Ap--0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; friable when moist; many, fine roots; neutral; clear, smooth boundary.

B1--10 to 12 inches, brown (10YR 5/3) heavy silt loam that has common, fine, faint mottles of yellowish brown (10YR 5/4 and 5/8); weak, fine and medium, subangular blocky structure; friable when moist; coatings of gray (10YR 6/1) silt on ped faces; common concretions of iron and manganese; slightly acid; clear, smooth boundary.

B21t--12 to 15 inches, pale-brown (10YR 6/3) silty clay loam that has common, medium, distinct mottles of yellowish brown (10YR 5/6), grayish brown (10YR 5/2), and light brownish gray (10YR 6/2); moderate, medium, subangular blocky structure; firm when moist; thin and medium films of dark grayish-brown (10YR 4/2) clay on some ped faces; common concretions of iron and manganese; slightly acid; clear, smooth boundary.

B22tg--15 to 28 inches, dark grayish-brown (10YR 4/2) silty clay loam that has many, medium, distinct mottles of pale brown (10YR 6/3) and yellowish brown (10YR 5/6); moderate, medium,

subangular blocky structure; firm when moist; medium films of dark grayish-brown (10YR 4/2) clay on many ped faces; common concretions of iron and manganese; medium acid; clear, wavy boundary.

IIB23tg--28 to 40 inches, dark-gray (10YR 4/1) clay loam that has many, medium, distinct mottles of brown (7.5YR 5/4) and strong brown (7.5YR 5/6); moderate, medium and coarse, subangular blocky structure; firm when moist; medium films of dark-gray (10YR 4/1) clay on ped faces; common concretions of iron and manganese; medium acid; clear, wavy boundary.

IIB3t--40 to 54 inches, light olive-brown (2.5Y 5/4) clay loam that has many, medium, distinct mottles of gray (10YR 5/1); weak, coarse, subangular blocky structure; firm when moist; thin, discontinuous films of gray (10YR 5/1) clay on ped faces; slightly acid; abrupt, wavy boundary.

IIC--54 to 60 inches, yellowish-brown (10YR 5/6) loam till that has grayish-brown (2.5Y 5/2) mottles; massive or weak, coarse, subangular blocky structure; friable when moist; calcareous.

Depth to mottling ranges from 8 to 14 inches. The silt mantle ranges from 18 to 40 inches in thickness, but is 24 to 38 inches thick in most areas. Depth to calcareous loam till ranges from 42 to 60 inches.

Fincastle silt loam (0 to 2 percent slopes) (Fc).--This soil occupies irregularly shaped, slight rises that are surrounded by Brookston silty clay loam soils. The areas of this soil range from 2 to 80 acres in size.

Included in mapping are a few, small areas in the northwestern part of the county that are underlain by stratified fine sand and silt, and areas as much as 15 acres in size in the west-central part of the county that have a gravelly substratum. Also included are small areas of Brookston silty clay loam, Russell silt loam, 0 to 2 percent slopes, and Crosby silt loam, 0 to 2 percent slopes.

Most areas are intensively cultivated. The major crops are corn and soybeans, but small grains and grass-legume hay are also grown. Small areas are woodlots. Runoff is very slow, and wetness is the main limitation to use. (Capability unit IIw-2)

Fox Series

The Fox series consists of deep, well-drained, nearly level to sloping soils on outwash terraces adjacent to bottom lands. These soils are underlain by gravel and sand at a depth of 29 to 42 inches. They formed in thin deposits of loess under mixed hardwoods (pl. I).

The surface layer is very dark grayish brown silt loam about 2 inches thick. The subsurface layer is slightly acid, dark yellowish-brown silt loam about 6 inches thick.

The subsoil is about 29 inches thick. The upper part is slightly acid, dark-brown silt loam. The middle is slightly acid, reddish-brown silty clay loam. It contains enough sand to make it feel gritty. The lower part is medium acid to neutral, reddish-brown clay loam that grades to very dark grayish brown gravelly clay loam, tongues of which extend into the underlying material.

The underlying material is light yellowish-brown, calcareous, stratified gravel and sand.

Fox soils are moderate in organic matter content. Permeability is moderate, and the available water capacity is moderate to low. These soils are easy to cultivate, and crops on them respond well to additions of lime and a complete fertilizer.

Fox soils are mostly cultivated, but large areas are used for pasture, hay, and trees. These soils are suited to all crops commonly grown in the county, especially small grains, grasses, and legumes.

Representative profile of Fox silt loam, 0 to 2 percent slopes, SW1/4 NW1/4 NE1/4 sec. 2, T. 23 N., R. 2 E., in a wooded area:

A1--0 to 2 inches, very dark grayish brown (10YR 3/2) silt loam; weak, fine, granular structure; friable when moist; neutral; clear, smooth boundary.

A21--2 to 5 inches, dark yellowish-brown (10YR 3/4) silt loam; weak, thin, platy structure; friable when moist; slightly acid; clear, smooth boundary.

A22--5 to 8 inches, dark yellowish-brown (10YR 3/4) silt loam; weak, fine and very fine, subangular blocky structure; friable when moist; slightly acid; clear, wavy boundary.

B1--8 to 12 inches, dark-brown (10YR 4/3) silt loam; moderate, fine, subangular blocky structure; firm when moist; slightly acid; clear, wavy boundary.

IIB21t--12 to 18 inches, reddish-brown (5YR 4/4) silty clay loam; moderate, fine, angular blocky structure; firm when moist; thin to medium clay films on many ped faces; slightly acid; clear, wavy boundary.

IIB22t--18 to 29 inches, reddish-brown (5YR 4/4) clay loam; moderate, medium, angular blocky structure; firm when moist; thin to medium clay films on many ped faces; medium acid; clear, wavy boundary.

IIB23t--29 to 37 inches, very dark grayish brown (10YR 3/2) gravelly clay loam; weak, coarse, subangular blocky structure; firm when moist; medium acid in upper part becoming neutral in the lower part; abrupt, irregular boundary; tongues extend into underlying material.

IIIC--37 to 70 inches, stratified, light yellowish-brown (10YR 6/4) gravel and sand; single grain; loose; calcareous.

The combined thickness of the A and B horizons ranges from 29 to 42 inches. The Ap horizon ranges from dark grayish brown to brown. Where Fox soils grade to Ockley soils, the B1 and B21t horizons are silty clay loam. The number, thickness, and length

of tongues in the IIB23t horizon vary within short distances. The IIB21t and IIB22t horizons range from dark brown to reddish brown. Commonly the IIB21t horizon has enough sand to make it feel gritty.

Fox silt loam, 0 to 2 percent slopes (FoA).--This soil has the profile described as representative of the series. It occurs on terraces that are 5 to 20 feet above the bottom lands of major drainageways. The areas of this soil are elongated and normally less than 30 acres in size. The uppermost 8 inches of cultivated soil is dark grayish-brown to brown silt loam. Runoff is very slow.

Included with this soil in mapping are small areas along the west edge of the county where the surface layer is loam or fine sandy loam. Also included are small strips of Fox silt loam, 2 to 6 percent slopes, eroded.

This soil is used mostly for crops, mainly corn and soybeans. Drought is a hazard later in the growing season. Management is needed to conserve soil moisture. Cultivation of this soil can be moderately intensive. (Capability unit IIs-1)

Fox silt loam, 2 to 6 percent slopes, eroded (FoB2).--The profile of this soil is similar to that described as representative of the series except that the surface layer is 4 to 6 inches thick and the clay loam and gravelly or sandy clay loam subsoil is about 27 inches thick . This soil occupies gently sloping areas near major drainageways. Runoff is slow.

Included with this soil in mapping are small areas of soils that have a surface layer about 9 inches thick, of soils that are severely eroded, and of soils that have a loam or fine sandy loam surface layer.

This soil is used mostly for crops. Small areas are used for permanent pasture, hay, and trees. Erosion is a moderate hazard. Drought is a hazard late in the growing season. Good management includes practices that conserve soil moisture. Cultivation of this soil can be moderately intensive. (Capability unit IIe-9)

Fox soils, 6 to 12 percent slopes, severely eroded (FsC3).--The profile of these soils is similar to that described as representative of the series except that most of the original surface layer has been removed by erosion and the plow layer consists of reddish-brown subsoil material that ranges from silt loam to sandy clay loam in texture. Also, the gravelly and sandy clay loam subsoil is about 21 inches thick. These soils occupy narrow strips on outwash terraces near small drainageways. Areas of these soils are generally less than 26 acres in size. Runoff is medium.

Included with these soils in mapping are small areas of moderately sloping and steep soils from which all or nearly all of the original surface layer has been eroded. Also included are small areas of moderately steep and steep Fox soils that have a surface layer 6 to 10 inches thick.

In most areas, Fox soils are used for small grains, permanent pasture, and grass-legume hay. Small areas are used for row crops. Erosion is a severe hazard. Drought is a hazard late in the growing season. Good management includes practices that conserve soil moisture and reduce erosion. Row crops should be grown only occasionally. (Capability unit IVe-9)

Genesee Series

The Genesee series consists of deep, well-drained, nearly level soils that formed in alluvium washed from highly calcareous glacial drift. These soils occupy bottom lands adjacent to major drainageways.

The surface layer is neutral, brown silt loam about 9 inches thick.

The underlying material, to a depth of about 60 inches, is neutral, dark yellowish-brown silt loam. It contains enough sand to make it feel gritty. Below this is stratified, calcareous gravel and sand.

Genesee soils are moderate in organic-matter content. These soils generally do not need lime, but crops on them respond well to a complete fertilizer. The available water capacity is high, and the permeability is moderate. Flooding is a hazard in winter or early in spring.

Most areas are intensively cultivated. Some are in permanent pasture or trees. These soils are well suited to all the row crops commonly grown in the county. Except where they are protected from spring floods by levees, Genesee soils are not suited to small grains or legumes that are planted in fall and mature in spring or early in summer.

Representative profile of Genesee silt loam, 160 feet south and 150 feet east of junction of levee and county road 80S, NW1/4 SE1/4 NW1/4 sec. 32, T. 24 N., R. 3 E., in a cultivated field:

Ap--0 to 9 inches, brown (10YR 4/3) silt loam; weak, fine and medium, granular structure; friable when moist; few worm casts; few, fine roots; neutral; clear, smooth boundary.

C1--9 to 29 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine and medium, granular structure; friable when moist; common, fine pores; neutral; gradual, wavy boundary.

C2--29 to 60 inches, dark yellowish-brown (10YR 4/4) silt loam; massive or weak, fine, granular structure; friable when moist; neutral.

The Ap horizon is neutral or slightly alkaline and ranges from dark brown to dark yellowish brown. In uncultivated areas the surface layer is very dark grayish brown to a depth of 1 to 3 inches. Where Genesee soils grade to Shoals soils, faint mottles are common below a depth of 30 inches. Below a depth of 3 feet, the C horizon varies within short distances from silt loam to sand or gravel. Even where the texture is silt loam, it commonly contains enough sand to make it feel gritty.

Genesee silt loam (0 to 2 percent slopes) (Gh).--This soil is on flood plains adjacent to Wildcat Creek and its major tributaries. Included in mapping are long, narrow areas along the natural levees in which the soils have more sand in the surface layer than this soil has. Also included are soils that have gray mottles below a depth of 20 inches, and small areas of Shoals silt loam in narrow meander channels that surround large areas of Genesee silt loam.

Flooding in winter or early in spring is the main hazard. Runoff is slow, and erosion is a slight hazard. This soil is well suited to crops commonly grown in the county if they are planted late in spring, or if the soil is protected by levees. Areas of this soil more than 5 acres in size that are not dissected by streams are commonly used to grow corn continuously. (Capability unit I-2)

Gravel Pits

Gravel pits (Gp) is near Wildcat Creek and its major tributaries. The largest pits are in the outwash terraces or bottom lands. Abandoned pits 1/2 acre to 5 acres in size occur near creeks in all parts of the county. Many of these pits are partly filled with water. Willow trees and shrubs that provide habitat for wildlife grow in or near the pits, and pits that have more than 6 feet of water are stocked with fish. (Capability unit VIIIs-2)

Hennepin Series

The Hennepin series consists of deep, well-drained, steep and very steep soils on uplands. These soils occupy narrow areas between the flood plains and the uplands and V-shaped valleys on the till plains. These soils formed in calcareous loam glacial till under a forest of hardwood trees.

The surface layer is neutral, very dark grayish-brown loam about 5 inches thick. The subsurface layer is neutral, dark-brown loam about 7 inches thick.

The subsoil is neutral, dark yellowish-brown heavy loam about 3 inches thick. It is friable.

The underlying material is calcareous, yellowish-brown loam till.

Hennepin soils are moderate in organic-matter content. The available water capacity is high, runoff is very rapid, and the permeability is moderate.

Hennepin soils are mostly in hardwood forest, mainly oak, hickory, and maple. A few areas of less steep soils have been cleared and are used for permanent pasture.

Representative profile of Hennepin loam, 25 to 60 percent slopes, SE1/4 NW1/4 sec. 7, T. 23 N., R. 3 E., in a wooded area:

A1--0 to 5 inches, very dark grayish brown (10YR 3/2) loam; moderate, fine, granular structure; friable when moist; abundant, fine roots; neutral; clear, smooth boundary.

A2--5 to 12 inches, dark-brown (10YR 4/3) loam; moderate, fine, granular structure; friable when moist; abundant, fine roots; neutral; clear, smooth boundary.

B--12 to 15 inches, dark yellowish-brown (10YR 4/4) heavy loam; weak, fine, subangular blocky structure; friable when moist; neutral; abrupt, wavy boundary.

C--15 to 60 inches, yellowish-brown (10YR 5/4) loam till; massive; friable when moist; calcareous.

The A horizon ranges from 4 to 14 inches in thickness. The A1 horizon ranges from very dark brown to dark brown. The A2 horizon is loam or silt loam. In places it contains enough sand to make it feel gritty. Where present, the B horizon is generally less than 5 inches thick and is clay loam or heavy loam. Depth to calcareous glacial till ranges from 5 to 17 inches. The texture of the till is loam, silt loam, coarse clay loam, or silty clay loam.

Hennepin loam, 25 to 60 percent slopes (HeE).--This soil occurs in long narrow strips less than 30 acres in size that are adjacent to drainageways.

Included in mapping are small, narrow bands of less steep soils that have a somewhat thicker B horizon than described as representative. Where associated with Fox or Ockley soils in the western part of the county, Hennepin soils on the upper part of slopes have a gravelly substratum.

Almost all the acreage is woodland. Erosion is a severe hazard where the cover vegetation is removed. This soil is well suited to hardwood trees and habitat for woodland wildlife. (Capability unit VIIe-2)

Kokomo Series

The Kokomo series consists of deep, very poorly drained soils in slight depressions on upland till plains. These soils formed under water-tolerant grasses, shrubs, and hardwood trees.

The surface layer is silty clay loam about 15 inches thick. The upper 9 inches is very dark gray, and the lower 6 inches is black.

The subsoil is neutral and is about 44 inches thick. The upper part is dark-gray heavy silty clay loam mottled with dark yellowish brown and yellowish brown. The lower part is olive-gray silty clay loam mottled with strong brown and yellowish brown.

The underlying material is brown, calcareous loam glacial till. It is friable.

Kokomo soils are high in organic-matter content. The available water capacity is high, and the permeability is slow. If these soils are plowed when wet, clods form that are difficult to break down into a seedbed.

Most areas of Kokomo soils are intensively cultivated. Corn and soybeans are the main crops, but small grains and legume-grass hay are also grown. Areas of undrained Kokomo soils are generally woodland.

Representative profile of Kokomo silty clay loam, 145 feet north of railroad and 155 feet east of county road 50E, NW1/4 NW1/4 sec. 8, T. 23 N., R. 4 E., in a cultivated field:

Ap--0 to 9 inches, very dark gray (10YR 3/1) silty clay loam; weak, fine and medium, granular structure; friable when moist; neutral; abrupt, smooth boundary.

A12--9 to 15 inches, black (10YR 2/1) silty clay loam; moderate, fine and medium, angular blocky structure; firm when moist; neutral; gradual, smooth boundary.

B21tg--15 to 31 inches, dark-gray (5Y 4/1) heavy silty clay loam that has common, medium, distinct mottles of dark yellowish brown (10YR 4/4) and few, medium, distinct mottles of yellowish brown (10YR 5/6); moderate, medium and fine, subangular blocky and angular blocky structure; firm when moist; thin, discontinuous films of olive-gray (5Y 5/2) clay on ped faces; coatings of very dark gray (10YR 3/1) silty clay loam on walls of root channels; neutral; gradual, smooth boundary.

B22tg--31 to 59 inches, olive-gray (5Y 5/2) silty clay loam that has common, coarse, distinct mottles of strong brown (7.5YR 5/6) and yellowish brown (10YR 5/8); moderate, coarse, subangular blocky structure; firm when moist; very thin, discontinuous films of olive-gray (5Y 5/2) clay on many ped faces; 2 percent, by volume, is till pebbles 5 to 10 millimeters in diameter; coatings of very dark gray (10YR 3/1) silty clay loam on walls of root channels; neutral; abrupt, wavy boundary.

Cg--59 to 64 inches, brown (10YR 5/3) loam till; massive; friable when moist; calcareous.

The A horizon ranges from 14 to 22 inches in thickness and is black to very dark grayish brown. Where Kokomo soils grade to Brookston soils, the A horizon is thinner. The B horizon ranges from 31 to 60 inches in thickness. The texture is heavy silty clay loam to silty clay. The texture of the underlying glacial till is loam, silt loam, or light clay loam.

Kokomo silty clay loam (0 to 2 percent slopes) (Kk).--This soil has the profile described as representative of the series. It occupies low depressions and swales in most nearly level areas in the county. It occurs in elongated areas less than 25 acres in size.

Included in mapping are small areas of soils that have a few inches of stratified material over the loam till substratum and, in the center of depressions, small areas of soils that have calcareous silt loam to silty clay layers at a depth of 18 to 36 inches. These layers contain numerous small shells and shell fragments. Also included are small strips of Brookston silty clay loam on the upper edges of depressions.

Wetness is the major hazard. If this soil is plowed when wet, many large clods form that are difficult to break down into a seedbed. Where adequately drained, this soil is suited to all crops commonly grown in the county. Where this soil is not drained, it is ponded much of the year and is used for pasture, woodland, or as habitat for wetland wildlife. (Capability unit IIw-1)

Kokomo silt loam, overwash (0 to 2 percent slopes) (Ko).--The profile of this soil is similar to that described as representative of the series except that the uppermost 10 to 18 inches is slightly acid, dark-brown silt loam that is granular and friable when moist. The underlying material is fine sand, silt, or loam till.

Included with this soil in mapping are narrow strips of Brookston and Kokomo silty clay loams at the upper edges of depressions.

Wetness is the major hazard. Where adequately drained, this soil is well suited to corn and soybeans. Drained soil is friable and easy to work. Where this soil is not drained, it is ponded much of the year and is used for pasture or as habitat for wetland wildlife. (Capability unit IIw-1)

Linwood Series

The Linwood series consists of deep, very poorly drained soils that have a muck surface layer over mottled, medium-textured underlying material. These soils occupy depressions 2 to 15 acres in size on till plains. They formed under water-tolerant hardwood trees, sedges, and grasses.

The surface layer is neutral, black muck about 18 inches thick.

The underlying material is very dark grayish brown calcareous silt loam mottled with grayish brown.

Linwood soils are very high in organic-matter content. The available water capacity is high, the water table is seasonally near the surface, and runoff is very slow or ponded. The permeability of the muck is rapid, and that of the underlying material is moderate.

Most areas of Linwood soils are not drained and are used as habitat for wetland wildlife or for permanent pasture. Where adequately drained, these soils are well suited to corn and vegetable crops.

Representative profile of Linwood muck, 1,121 feet west and 690 feet north of junction of county roads 600E and 400S, SE1/4 SE1/4 sec. 24, T. 23 N., R. 4 E., in a field covered by scrub hardwoods and grass:

1--0 to 8 inches, black (10YR 2/1) muck; weak, very coarse, granular structure; friable when moist; many, fine roots; neutral; clear, smooth boundary.

413-808 O - 71 - 2

2--8 to 18 inches, black (10YR 2/1) muck; massive or weak, very coarse, angular blocky structure; friable when moist; neutral; abrupt, wavy boundary.

IIC1--18 to 38 inches, very dark grayish brown (10YR 3/2) silt loam that has common, medium, distinct mottles of grayish brown (10YR 5/2); massive or weak, very coarse, prismatic structure; friable when moist; black (5Y 2/1) organic coatings on ped faces; many small shells and shell fragments in the lower part; neutral in the upper part grading to calcareous in the lower part.

IIC2--38 to 60 inches, light brownish-gray (10YR 6/2) silt loam that has many, medium, distinct mottles of yellowish brown (10YR 5/6); massive; friable when moist; many partly decomposed shell fragments; calcareous.

The muck layer ranges from 12 to 26 inches in thickness. The structure of the 2 horizon is weak and varies from granular to blocky. The IIC horizon is generally silt loam or loam and is neutral or moderately alkaline. The content of small shells and shell fragments varies widely.

Linwood muck (0 to 2 percent slopes) (Lw).--This soil occupies swales and deep depressions throughout the county. Included in mapping are small areas where the muck is 12 inches thick over silty clay loam material. Also included are small areas of Carlisle muck in the deepest depressions and small, narrow strips of Kokomo and Brookston silty clay loams near the edges of deep depressions.

Wetness is the major hazard. Where adequately drained, this soil is well suited to corn and some vegetable crops. Soil blowing is a hazard where this soil is cleared and drained. If well managed, this soil can be cultivated intensively. (Capability unit IIw-10)

Made Land

Made land (Ma) consists of refuse dumps on the flood plains of major creeks. Areas no longer used as refuse dumps are leveled and are covered with several feet of cinders or dirt on which weeds and grasses grow. (Capability unit VIIIs-2)

Miami Series

The Miami series consists of deep, well-drained, gently sloping to strongly sloping soils on uplands. These soils occupy narrow areas adjacent to Wildcat Creek and its tributaries. These soils formed in loam glacial till under a forest of mixed hardwoods.

The surface layer is dark-brown silt loam about 7 inches thick.

The subsoil is clay loam about 25 inches thick. The upper three-fourths is dark yellowish brown and strongly acid; the rest is olive brown and neutral.

The underlying material is olive-brown, calcareous, loam glacial till.

Permeability is moderate, and the available water capacity is high. Runoff is slow on gentle slopes and very rapid on strong slopes.

Miami soils are used mostly for crops. Small areas are in permanent pasture or are used for legume-grass hay. A few areas are woodlots 2 to 10 acres in size. Where fertilized and protected from erosion, Miami soils are well suited to all crops commonly grown in the county.

Representative profile of Miami silt loam, 2 to 6 percent slopes, 15 feet north and 75 feet east of second fence corner south of gravel pit, one-half mile west and one-eighth mile south of the NE. corner of sec. 8, T. 24 N., R. 4 E., in a cultivated field:

Ap--0 to 7 inches, dark-brown (10YR 4/3) silt loam; weak, medium, granular structure; friable when moist; abundant, fine roots; slightly acid; abrupt, smooth boundary.

IIB21t--7 to 17 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm when moist; thin films of dark-brown (10YR 4/3) clay on ped faces; common, very small pebbles and a few pebbles 30 millimeters in diameter; few, fine roots along ped faces; strongly acid; clear, wavy boundary.

IIB22t--17 to 27 inches, dark yellowish-brown (10YR 4/4) clay loam; weak, coarse, subangular blocky structure; firm when moist; thin films of dark-brown (10YR 4/3) clay on ped faces; many small glacial pebbles and a few pebbles 30 millimeters in diameter; very few roots, mostly along ped faces; strongly acid; clear, smooth boundary.

IIB3t--27 to 32 inches, olive-brown (2.5Y 4/4) clay loam; weak, very coarse, subangular blocky structure; firm when moist; very thin, discontinuous films of dark-brown (10YR 4/3) clay on ped faces; many small glacial pebbles; neutral; abrupt, wavy boundary.

IIC--32 to 60 inches, olive-brown (2.5Y 4/4) heavy loam till; massive; friable when moist; many, small glacial pebbles and a few pebbles 1 to 3 inches in diameter; calcareous.

The Ap horizon ranges from 6 to 10 inches in thickness and is dark grayish brown or dark brown. An A2, a B1, or both of these horizons are commonly present and singly or combined are 2 to 3 inches thick. The B horizon ranges from 16 to 32 inches in thickness. The IIB21t horizon ranges from silty clay loam to clay loam in texture. The lower B horizons are heavy or light clay loam. The C horizon is mainly loam, but may be light clay loam or silt loam.

Miami silt loam, 2 to 6 percent slopes, eroded (MlB2).--This soil has the profile described as representative of the series. It occupies low knolls adjacent to small drainageways. The largest areas are near Wildcat Creek and its main tributaries. The areas generally are elongated and range from 2 to 50 acres in size.

Included in mapping are small areas of gently sloping, severely eroded Miami soils in the middle of some slopes. Narrow strips of Brookston silty clay loam occur in some drainageways. Also included are wooded areas of Miami silt loam that have a dark surface layer 2 to 3 inches thick. Included in Russiaville and Kokomo are areas formerly covered by this soil that have been so mixed or disturbed by community development that the soils cannot be identified.

Limitations to use for crops are moderate. Erosion is the main hazard. (Capability unit IIe-1)

Miami silt loam, 6 to 12 percent slopes, eroded (MlC2).--The profile of this soil is similar to that described as representative of the series except that the surface layer is about 6 inches thick and is mixed with a small amount of clay loam subsoil. The dark yellowish-brown subsoil is thinner than that described.

This Miami soil occurs near the head of small, intermittent streams and drainageways. The areas are generally elongated and 2 to 15 acres in size.

Included with this soil in mapping are wooded areas of moderately sloping Miami silt loams that have a surface layer 2 to 3 inches thick. Included in Kokomo are areas formerly covered by this soil that have been so mixed or disturbed by community development that the soils cannot be identified.

This soil is suited to small grains, pasture, and hay. A row crop of corn or soybeans can be grown occasionally. Erosion is a severe hazard where the soils are cultivated. (Capability unit IIIe-1)

Miami clay loam, 2 to 6 percent slopes, severely eroded (MmB3).--The profile of this soil is similar to that described as representative of the series except that erosion has removed most of the original surface soil. The plow layer consists mostly of the dark yellowish-brown clay loam subsoil material mixed with a small amount of the dark-brown surface soil. This soil is lighter colored, contains less organic matter, and is more difficult to plow than the soil described as representative of the series. The subsoil is about 22 inches thick.

This Miami soil occupies long, narrow areas generally less than 8 acres in size near the heads of small drainageways. Where surrounded by somewhat poorly drained Crosby or Fincastle soils, this soil is referred to as clay knobs.

Included with this soil in mapping the western part of the county are small areas of soils that have a thin, sandy or gravelly clay loam layer above the glacial till. Also included are small areas of Miami silt loam, 2 to 6 percent slopes, eroded.

This soil is used for crops, mainly corn and soybeans. Because it occurs in small areas, the soil is generally managed the same way as the surrounding soils. Erosion is a severe hazard. (Capability unit IIIe-1)

Miami clay loam, 6 to 12 percent slopes, severely eroded (MmC3).--The profile of this soil is similar to that described as representative of the series except that erosion has removed most of the original surface layer and, in places, the upper part of the subsoil. The plow layer consists of the dark yellowish-brown clay loam subsoil mixed with a small amount of the original dark-brown surface soil. This soil is lighter colored, contains less organic matter, and is more difficult to plow than the soil described as representative of the series. Depth to calcareous loam glacial till is 24 to 28 inches.

This Miami soil occupies areas near the heads of small intermittent streams and drainageways. The areas are long and narrow and generally less than 20 acres in size.

Included in mapping are a few areas less than 24 inches deep over till and small areas of Miami silt loam, 6 to 12 percent slopes, eroded. Also included are small areas of soils that have a thin, sandy or gravelly clay loam layer above the loam glacial till.

This soil is suited to small grains and pasture crops. A row crop of corn or soybeans can be grown occasionally. Erosion is a severe hazard. (Capability unit IVe-1)

Miami clay loam, 12 to 18 percent slopes, severely eroded (MmD3).--The profile of this soil is similar to that described as representative of the series except that the plow layer consists mostly of the dark yellowish-brown clay loam subsoil. In places it is mixed with a small amount of the original dark-brown surface soil. This Miami soil is lighter colored, contains less organic matter, and is underlain by calcareous till at a depth of 24 to 28 inches.

This Miami soil occupies areas adjacent to Wildcat Creek and its tributaries. The areas are long and narrow and generally less than 12 acres in size. Runoff is very rapid.

Included in mapping are a few areas of soils that are less than 24 inches deep over calcareous till. Also included are small areas of steep soils that have a thin subsoil.

This soil is well suited to pasture or hay. A small grain, such as wheat or oats, can be grown occasionally. Erosion is a severe hazard on cultivated soils. (Capability unit VIe-1)

Morley Series

The Morley series consists of deep, well-drained, gently sloping to moderately sloping soils that are along major drainageways. These soils formed in calcareous silty clay loam glacial till under a forest of mixed hardwoods.

The surface layer is dark grayish-brown silt loam about 5 inches thick. It is friable and easy to work.

The subsoil is about 28 inches thick. The upper part is friable, dark yellowish-brown silt loam. The middle part is medium acid, dark yellowish-brown and dark-brown silty clay loam. The lower part is slightly acid to mildly alkaline, dark-brown silty clay loam.

The underlying material is brown, calcareous silty clay loam till.

Morley soils are moderate in organic-matter content. Crops on them respond well to lime and a complete fertilizer. The available water capacity is high, permeability is slow, and runoff is slow to rapid.

Morley soils are used mostly for crops. Where limed and fertilized, and protected from erosion, these soils are suited to all the crops commonly grown in the county. Small areas are in permanent pasture or are used for legume-grass hay. A few areas are woodlots 2 to 10 acres in size.

Representative profile of Morley silt loam, 2 to 6 percent slopes, eroded, 40 feet west of the SE. corner, NW1/4 NW1/4 NW1/4 sec. 11, T. 5 S., R. 23 N., in a cultivated field:

Ap--0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable when moist; many, fine roots; few, small glacial pebbles; neutral; abrupt, smooth boundary.

B1--5 to 10 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; moderate, fine and medium, subangular blocky structure; friable when moist; coatings of grayish-brown (10YR 5/2) silt on ped faces; few, small glacial pebbles; few roots; slightly acid; clear, smooth boundary.

B21t--10 to 16 inches, dark yellowish-brown (10YR 4/4) heavy silty clay loam; moderate, medium, subangular blocky structure; firm when moist; films of brown (10YR 5/3) clay on ped faces; many, small glacial pebbles; few roots, mostly along ped faces; medium acid; clear, wavy boundary.

B22t--16 to 25 inches, dark-brown (10YR 4/3) heavy silty clay loam; moderate, coarse, angular blocky structure; firm when moist; thin films of brown (10YR 5/3) clay on ped faces; few, fine roots along ped faces; many, small glacial pebbles; medium acid; abrupt, wavy boundary.

B3--25 to 33 inches, dark-brown (10YR 4/3) silty clay loam; moderate, coarse, angular blocky structure; firm when moist; thin films of grayish-brown (10YR 5/2) clay on ped faces; many glacial pebbles; very few roots along ped faces; slightly acid in the upper part and mildly alkaline in the lower part; clear, wavy boundary.

C--33 to 48 inches, brown (10YR 4/3) silty clay loam till; massive; firm when moist; many glacial pebbles; calcareous.

The Ap horizon ranges from dark grayish brown to brown and from 5 to 10 inches in thickness. The A2 and B1 horizons are mixed by plowing. The B horizon ranges from dark yellowish brown to dark brown. The B1 horizon ranges from heavy silt loam to silty clay loam in texture, and the other B horizons range from silty clay to heavy clay loam. Depth to calcareous silty clay loam glacial till ranges from 15 to 36 inches, depending on the slope and degree of erosion.

Morley silt loam, 2 to 6 percent slopes, eroded (MrB2).--This soil has the profile described as representative of the series. It occurs along Wildcat Creek and other streams and drainageways. The plow layer is a mixture of the dark grayish-brown surface soil and a small amount of dark yellowish-brown silty clay loam subsoil material.

Included in mapping are wooded soils that have a dark surface layer 2 to 3 inches thick. Also included are small areas of Morley silty clay loam, 2 to 6 percent slopes, severely eroded, and of Blount silt loam, 2 to 4 percent slopes, eroded.

Erosion is a moderate hazard where this soil is cultivated. (Capability unit IIe-6)

Morley silty clay loam, 2 to 6 percent slopes, severely eroded (MsB3).--The profile of this soil is similar to that described as representative of the series except that the plow layer consists largely of dark yellowish-brown silty clay loam subsoil mixed with a small amount of dark grayish-brown silt loam surface soil. Also, the surface layer is lighter in color, lower in organic-matter content, and more difficult to plow. This Morley soil occupies areas along Wildcat Creek and other streams and drainageways. Runoff is medium.

Included in mapping are small areas of Morley silt loam, 2 to 6 percent slopes, eroded, and of Blount silt loam, 2 to 4 percent slopes, eroded.

Because it occurs in small, irregularly shaped areas, this soil is generally managed the same way as the surrounding soils. Erosion is the main hazard. This soil is moderately well suited to most commonly grown crops. Limitations to use for crops are severe. (Capability unit IIIe-6)

Morley silty clay loam, 6 to 12 percent slopes, severely eroded (MsC3).--The profile of this soil is similar to that described as representative of the series except that erosion has removed most of the original surface layer and part of the subsoil. This soil is lighter colored, contains less organic matter, and is more difficult to plow than Morley silt loam, 2 to 6 percent slopes, eroded. The plow layer consists mostly of dark yellowish-brown silty clay loam subsoil mixed with a small amount of the original dark grayish-brown silt loam surface layer. Depth to the underlying calcareous silty clay loam glacial till ranges from 15 to about 22 inches. This Morley soil occupies areas adjacent to Wildcat Creek and other streams and drainageways.

Included in mapping are small areas of strongly sloping soils that have a dark grayish-brown silt loam surface layer 4 to 6 inches thick. Also included in the east-central part of the county are small areas of steep soils that have little or none of the original surface layer.

This soil is well suited to small grains and pasture crops. It is only moderately well suited to row crops, but corn or soybeans can be grown occasionally. Erosion is a severe hazard. (Capability unit IVe-6)

Ockley Series

The Ockley series consists of deep, well-drained, level and gently sloping soils on outwash terraces. These soils are adjacent to the bottom lands of major streams, mainly in the western half of the county. They formed in loess 12 to 24 inches thick and the underlying strata of gravel and sand.

The surface layer is dark grayish-brown silt loam about 8 inches thick.

The subsoil is about 46 inches thick. The upper part is strongly acid, dark yellowish-brown silty clay loam. The middle part is medium acid, brown clay loam and sandy clay loam. The lower part is neutral, dark-brown gravelly clay loam, tongues of which extend into the underlying material.

The underlying material is yellowish-brown, calcareous, stratified gravel and sand.

Ockley soils are moderate in organic-matter content. The available water capacity is high, and the permeability is moderate. The plow layer is easy to work and is medium acid unless limed. Crops respond well to additions of lime and fertilizer.

Ockley soils are well suited to all crops commonly grown in the county. Most areas are intensively cultivated to corn and soybeans. Small grains and legume-grass hay are also grown. A few areas are in small woodlots.

Representative profile of Ockley silt loam, 0 to 2 percent slopes, 30 feet east and 20 feet south of the center of NW1/4 NE1/4 sec. 5, T. 24 N., R. 3 E., in a cultivated field:

Ap--0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium and fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B21t--8 to 16 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; moderate, medium, subangular blocky structure; firm when moist; films of dark yellowish-brown (10YR 3/4) clay on ped faces; strongly acid; clear, wavy boundary.

IIB22t--16 to 29 inches, brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm when moist; films of dark reddish-brown (5YR 3/4) clay on ped faces; medium acid; clear, wavy boundary.

IIB23t--29 to 39 inches, brown (7.5YR 4/4) sandy clay loam; weak, coarse, subangular blocky structure; firm when moist; films of dark reddish-brown (5YR 3/4) clay on ped faces; medium acid; clear, wavy boundary.

IIB3t--39 to 54 inches, dark-brown (10YR 3/3) gravelly clay loam; weak, coarse, subangular blocky structure; friable when moist; thin films of dark reddish-brown (5YR 3/4) clay on ped faces; neutral; abrupt, irregular boundary.

IIIC--54 to 100 inches, yellowish-brown (10YR 5/4), stratified gravel and sand; single grain; loose; calcareous.

The loess mantle ranges from 12 to 24 inches in thickness. The Ap horizon is dark grayish brown, brown, or dark brown. Where Ockley soils grade to Fox soils, the B21t horizon is silty clay loam that contains enough sand to make it feel gritty. The thickness, number, and length of tongues in the IIB3t horizon vary. Depth to the loose gravel and sand ranges from 42 to 60 inches.

Ockley silt loam, 0 to 2 percent slopes (OcA).--This soil has the profile described as representative of the series. It occupies irregularly shaped areas normally less than 30 acres in size that are 10 to 40 feet above soils on bottom lands. Runoff is slow.

Included with this soil in mapping are small areas of Fox silt loam, 0 to 2 percent slopes, and of Ockley silt loam, loamy substratum, 0 to 2 percent slopes. Also included are a few small areas of nearly level, wooded Ockley silt loam that has a very dark gray surface layer 1 to 3 inches thick. In other included areas, the lower part of the subsoil is a sandy rather than a gravelly clay loam.

Most of the acreage is intensively cultivated. Erosion is a slight hazard. During dry years, drought is a slight hazard late in the growing season. (Capability unit I-1)

Ockley silt loam, loamy substratum, 0 to 2 percent slopes (OkA).--The profile of this soil is similar to that described as representative of the series, but this soil is underlain by calcareous, loamy glacial till, is gravelly or sandy clay loam in the lower part of the subsoil, and in some places has as much as 12 inches of loose gravel and sand over the till. In wooded areas this soil has a very dark grayish-brown surface layer about 2 inches thick. This soil occupies areas where the outwash terraces grade to the upland till plains. The largest areas are 1/8 to 1/2 mile from Wildcat Creek or its main tributaries. Areas of this soil are irregular in shape and generally are less than 30 acres in size. Runoff is slow.

Included with this soil in mapping are small areas of Ockley silt loam, 0 to 2 percent slopes, and narrow strips of Ockley silt loam, loamy substratum, 2 to 6 percent slopes, eroded.

Most of the acreage is intensively cultivated to corn or soybeans. Erosion is a slight hazard. During dry years, drought is a slight hazard late in the growing season. (Capability unit I-1)

Ockley silt loam, 2 to 6 percent slopes, eroded (OcB2).--The profile of this soil is similar to that described as representative of the series except that the plow layer is a mixture of the original dark grayish-brown surface soil and a small amount of dark yellowish-brown silty clay loam subsoil. This soil occupies outwash terraces that are 10 to 40 feet higher than the adjacent bottom lands. Areas are generally long and narrow and range from 2 to 25 acres in size. Runoff is medium.

Included with this soil in mapping are small areas of Ockley silt loam, 0 to 2 percent slopes, and a few strips of Ockley silt loam, loamy substratum, 2 to 6 percent slopes, eroded. Also included

in wooded areas are soils that have a very dark grayish-brown surface layer about 2 inches thick.

This soil has only moderate limitations if used for the crops commonly grown in the county. Erosion is the main hazard. In dry years, drought is a slight hazard late in the growing season. (Capability unit IIe-3)

Ockley silt loam, loamy substratum, 2 to 6 percent slopes, eroded (OkB2).--The profile of this soil is similar to that described as representative of the series except that it is underlain by calcareous loam glacial till, that the lower part of the subsoil is gravelly or sandy clay loam, and that in places as much as 12 inches of loose gravel and sand is over the glacial till. This soil occupies areas where the outwash terraces grade to the upland till plains. The largest areas are 1/8 to 1/2 mile from Wildcat Creek or its main tributaries. Soil areas are elongated and generally less than 15 acres in size. Runoff is slow.

Included with this soil in mapping are small areas of Ockley silt loam, 2 to 6 percent slopes, eroded. Also included are wooded areas where this soil has a very dark grayish brown surface layer about 2 inches thick.

Limitations to use for crops commonly grown in the county are moderate. Erosion is the main hazard. In dry years, drought is a slight hazard late in the growing season. (Capability unit IIe-3)

Patton Series

The Patton series consists of deep, very poorly drained soils in wide, shallow valleys in the upland till plains. These soils formed under swamp grass, water-tolerant shrubs, and hardwood trees.

The surface layer is black silty clay loam about 12 inches thick.

The subsoil is silty clay loam about 25 inches thick. The upper part is dark gray and has strong-brown mottles. The middle part is dark gray and gray and has dark-brown mottles. The lower part is gray and has yellowish-brown mottles.

The underlying material is stratified, olive silt loam, silt, and fine sand mottled with yellowish brown and gray. It is friable and calcareous.

Patton soils are high in organic-matter content. Crops on these soils respond well to a complete fertilizer, but normally do not need lime. The available water capacity is high, and the permeability is moderately slow. The water table is high, and tile drains are needed for good crop growth. If these soils are plowed when wet, many large clods form that are hard when dry and are difficult to break down into a seedbed.

Most areas of Patton soils are intensively cultivated. Where adequately drained, these soils are well suited to all crops commonly grown in the county. Corn and soybeans are the main crops, but small grains and legume-grass hay are also grown. Woodlots 2 to 10 acres in size are in some areas of undrained soils.

Representative profile of Patton silty clay loam, loamy substratum, 413 feet south and 124 feet east of NW. corner of NE1/4 NW1/4 sec. 7, T. 24 N., R. 3 E., in a cultivated field:

Ap--0 to 8 inches, black (10YR 2/1) silty clay loam; weak, fine and medium, granular structure; firm when moist; many, fine roots; neutral; abrupt, smooth boundary.

A12--8 to 12 inches, black (10YR 2/1) fine silty clay loam; weak, fine, granular structure; firm when moist; neutral; gradual, smooth boundary.

B21g--12 to 15 inches, dark-gray (5Y 4/1) silty clay loam that has common, medium, distinct mottles of strong brown (7.5YR 5/6); moderate, fine and medium, angular blocky structure; firm when moist; stains of very dark gray (10YR 3/1) organic material on ped faces; few, fine roots; neutral; clear, smooth boundary.

B22g--15 to 32 inches, dark-gray (N 4/0) silty clay loam that has many, medium, distinct mottles of dark brown (7.5YR 4/4); moderate, medium, angular blocky structure; discontinuous stains of very dark gray (10YR 3/1) organic material on ped faces; firm when moist; neutral; clear, smooth boundary.

B3g--32 to 37 inches, gray (5Y 5/1) silty clay loam that has many, coarse, prominent mottles of yellowish brown (10YR 5/6) and yellowish red (5YR 5/8); moderate, coarse, angular blocky structure; firm when moist; neutral in upper part becoming mildly calcareous in lower part; abrupt, wavy boundary.

Cg--37 to 72 inches, olive (5Y 5/3), stratified silt loam, silt, and fine sand that have common, medium, distinct mottles of yellowish brown (10YR 5/6) and gray (5Y 5/1); massive; friable when moist; calcareous.

Where Patton soils grade to Fincastle or Crosby soils, the surface layer contains less organic matter. Ap and A12 horizons range from black to very dark gray, and their combined thickness is 10 to 14 inches. The B horizons are heavy silty clay loam to light silty clay loam. Depth to the C horizon ranges from 34 to about 60 inches. The thickness and sequence of the stratified layers of silt, silt loam, loamy sand, and sand vary within short distances.

Patton silty clay loam, loamy substratum (0 to 2 percent slopes) (Pa).--This soil has the profile described as representative of the series. It occupies wide, shallow valleys in the upland till plains. The areas of this soil are elongated and generally less than 50 acres in size. Runoff is very slow or ponded.

Included in mapping are irregularly shaped areas where the substratum is sandy and gravelly in places. Most are 4 to 20 acres in size and are in the western part of the county. The largest (E1/2 sec. 14, NW1/4 sec. 13, T. 24 N., R. 4 E.) is about

100 acres in size. Also included are small areas of Brookston silty clay loam around the edges of the valleys and Kokomo silty clay loam in the deeper depressions.

Wetness is the major hazard. Where adequately drained, this soil is well suited to all crops commonly grown. (Capability unit IIw-1)

Patton silty clay loam, occasionally flooded (Pc).--This soil occupies shallow swales adjacent to steep breaks in the flood plains. The areas of this soil are elongated and generally less than 10 acres in size. This soil has a profile similar to that described as representative of the series, except that the upper part of the subsoil is light silty clay loam and the depth to underlying stratified material is about 50 inches.

Included in mapping are small areas of soils that have less clay and more sand in the surface layer. Also included are small, narrow areas of Shoals silt loam and Genesee silt loam.

This soil is wet all year. It is flooded by streams and receives runoff water from steep soils and from springs at the base of escarpments. Where protected from floods by levees and adequately drained, this soil is well suited to growing corn continuously. Areas of undrained soil provide suitable habitat for wetland wildlife. (Capability unit IIw-1)

Pewamo Series

The Pewamo series consists of deep, very poorly drained soils in slight depressions in the upland till plains. These soils formed under swamp grass, water-tolerant shrubs, and hardwood trees.

The surface layer is very dark gray silty clay loam about 12 inches thick.

The subsoil is about 37 inches thick. The upper part is dark-gray silty clay mottled with olive brown and olive yellow, the middle part is gray silty clay loam mottled with olive yellow, and the lower part is gray silty clay mottled with yellowish brown.

The underlying material is yellowish-brown silty clay loam glacial till mottled with reddish yellow and dark grayish brown.

Pewamo soils are high in organic-matter content. These soils are neutral, and crops on them respond well to a complete fertilizer. The available water capacity is high, and the permeability is very slow. The water table is seasonally high, and artificial drainage is needed to insure good crop growth. If these soils are plowed when wet, many large clods form that are difficult to break down into a seedbed.

Where adequately drained and fertilized, Pewamo soils are well suited to all crops commonly grown in the county.

Representative profile of Pewamo silty clay loam, 280 feet south and 320 feet east of the NW. corner, SW1/4 NW1/4 sec. 12, T. 24 N., R. 5 E., in a cultivated field:

Ap--0 to 7 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium, granular structure; firm when moist; many, fine roots; neutral; abrupt, smooth boundary.

A12--7 to 12 inches, very dark gray (10YR 3/1) silty clay loam, very dark grayish brown (10YR 3/2) when crushed; moderate, fine and medium, subangular blocky structure; firm when moist; thin, discontinuous films of very dark gray (10YR 3/1) clay on ped faces; many, fine roots; neutral; clear, wavy boundary.

B21tg--12 to 22 inches, dark-gray (10YR 4/1) silty clay that has common, medium, distinct mottles of light olive brown (2.5Y 5/4) and olive yellow (2.5Y 6/6); moderate, medium, prismatic structure that breaks to strong, medium, angular blocky; firm when moist; thin films of very dark gray (10YR 3/1) clay on ped faces; few, fine roots along cleavage planes; neutral; clear, wavy boundary.

B22tg--22 to 37 inches, gray (10YR 5/1) heavy silty clay loam that has common, medium, distinct mottles of olive yellow (2.5Y 6/6); moderate, medium, prismatic structure that breaks to strong, medium, angular blocky; firm when moist; medium films of dark-gray (10YR 4/1) clay on ped faces; very few, fine roots along cleavage planes; root channels that are filled with very dark gray (10YR 3/1) silty clay loam; neutral; clear, wavy boundary.

B3tg--37 to 49 inches, gray (10YR 5/1) light silty clay that has many, coarse, distinct mottles of yellowish brown (10YR 5/6); weak, coarse, subangular blocky structure; firm when moist; films of dark-gray (10YR 4/1) clay on ped faces; root channels that are filled with very dark gray (10YR 3/1) silty clay loam; neutral; abrupt, wavy boundary.

Cg--49 to 60 inches, yellowish-brown (10YR 5/6) silty clay loam till that has many, medium, distinct mottles of reddish yellow (7.5YR 6/6) and dark grayish brown (2.5Y 4/2); streaks of gray (N 5/0 and N 6/0) lime along cleavage planes; massive or weak, very coarse, subangular blocky structure; firm when moist; calcareous.

The combined thickness of the Ap and A12 horizons ranges from 10 to 14 inches; these horizons are black to very dark grayish brown. The B horizons are gray, dark-gray, or olive-gray silty clay or silty clay loam. Depth to the C horizon ranges from 35 to 68 inches, but it generally is 35 to 49 inches.

Pewamo silty clay loam (Pe).--This soil occupies depressions, swales, and narrow necks that connect large areas of Blount soils. Runoff is very slow or ponded.

Included in mapping are small areas of Blount silt loam, 0 to 2 percent slopes. Where the Pewamo soil grades to Blount silt loam, it has a thinner and lighter colored surface layer than that

described as representative. Small, narrow bands of soils that are covered by less than 6 inches of eroded material are included where the Pewamo soils are adjacent to Blount silt loam, 2 to 4 percent slopes, eroded.

Almost all the acreage is intensively cultivated. Corn and soybeans are the main crops. Small areas are used for pasture or hay or for woodland. Wetness is the main hazard. (Capability unit IIw-1)

Quarries

Quarries (Qu) occur mainly in the central part of the county. The only quarry presently used as a source of limestone is southwest of Kokomo. All others have been abandoned and are partly filled with water. Vegetation, where present, consists mainly of weeds, briers, and scrub trees that provide some food and habitat for birds and other wildlife. (Capability unit VIIIs-2)

Russell Series

The Russell series consists of deep, well-drained, nearly level and gently sloping soils on upland till plains. They formed in moderately thick deposits of loess and the underlying loam glacial till under a forest of mixed hardwoods.

The surface layer is dark grayish-brown silt loam about 8 inches thick.

The subsoil is about 55 inches thick. The upper part is mainly strongly acid, dark yellowish-brown silty clay loam, and the middle part is dark-brown clay loam. The lower part is friable, dark-brown loam that is strongly acid in its upper part and neutral in its lower part.

The underlying material is calcareous, yellowish-brown loam glacial till.

Russell soils are moderate in organic-matter content. The permeability is moderate, and the available water capacity is high. Runoff is slow on the gently sloping soils and very slow on the nearly level soils.

Most areas of Russell soils are intensively cultivated. Where adequately fertilized, these soils are well suited to all crops commonly grown in the county. The main crops are corn and soybeans, but small grains and legume-grass hay are also grown. Small woodlots are in some areas. Management to control runoff and erosion is needed on the gently sloping soils.

Representative profile of Russell silt loam, 0 to 2 percent slopes, 800 feet west and 145 feet south of the NE. corner, NE1/4 NW 1/4 sec. 5, T. 24 N., R. 2 E., in a cultivated field:

Ap--0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable when moist; slightly acid; abrupt, smooth boundary.

B1--8 to 11 inches, dark yellowish-brown (10YR 3/4) silt loam; moderate, fine, subangular blocky structure; friable when moist; strongly acid; abrupt, smooth boundary.

B21t--11 to 23 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, fine and medium, subangular blocky structure; firm when moist; thin films of dark-brown (10YR 3/3) clay on many ped faces; strongly acid; clear, wavy boundary.

B22t--23 to 32 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium and coarse, subangular blocky structure; firm when moist; thin films of dark-brown (10YR 3/3) clay on ped faces; strongly acid; gradual, wavy boundary.

IIB23t--32 to 44 inches, dark-brown (7.5YR 4/4) clay loam; moderate, very coarse, subangular blocky structure; firm when moist; thin films of dark-brown (10YR 3/3) clay on many ped faces; strongly acid; gradual, wavy boundary.

IIB3--44 to 63 inches, dark-brown (7.5YR 4/4) loam; massive or weak, medium, subangular blocky structure; friable when moist; strongly acid in upper part, grading to neutral in lower part; abrupt, wavy boundary.

IIC--63 to 74 inches, yellowish-brown (10YR 5/4) loam till; massive; friable when moist; calcareous.

The Ap horizon ranges from 6 to 10 inches in thickness and from dark grayish brown to yellowish brown in color. The A2 and B1 horizons are generally mixed by deep plowing. The combined thickness of the silty layers varies within short distances, but it is more than 18 inches in all Russell soils. The B horizons are dark yellowish brown, dark brown, or brown. Depth to the C horizon ranges from 42 to 68 inches.

Russell silt loam, 0 to 2 percent slopes (RuA).--This soil has the profile described as representative of the series. It occurs mainly in Honey Creek township and in the southern part of Monroe, the western part of Harrison, and the northwestern part of Ervin townships. The areas of this soil are irregularly shaped and generally less than 40 acres in size. These areas are adjacent to somewhat poorly drained Fincastle soils. In many places strata of loose gravel and sand 5 to 30 feet thick are below a depth of 6 to 12 feet. Runoff is very slow.

Included in mapping are soils that have yellowish-brown and brownish-gray mottles below a depth of 2 feet. Also included, in areas 1/2 mile from the bottom land of major streams in the western part of the county, are small areas where a layer of sandy loam 2 to 6 inches thick is above the unweathered glacial till. In a few areas are soils that have a thin mantle of silt and that are leached to a depth of less than 42 inches.

Most of this soil is intensively cultivated. Erosion is a slight hazard. (Capability unit I-1)

Russell silt loam, 2 to 6 percent slopes, eroded (RuB2).--The profile of this soil is similar to that described as representative of the series except

that the plow layer is brown surface soil mixed with a moderate amount of dark yellowish-brown silty clay loam subsoil. This soil occupies low knolls and narrow strips adjacent to small drainageways. The largest areas are 1/4 to 1/2 mile from Wildcat Creek and its main tributaries. The areas of this soil are generally long and narrow and range from 2 to about 50 acres in size.

Included in mapping are small areas of soils that are mottled below a depth of 2 feet, and areas of wooded soils that have a very dark grayish brown surface layer 2 to 3 inches thick. Also included are small narrow strips of Russell silt loam, 0 to 2 percent slopes.

Limitations to use for crops are moderate. Erosion is the major hazard where this soil is cultivated. (Capability unit IIe-3)

Shoals Series

The Shoals series consists of deep, friable, somewhat poorly drained soils on bottom lands. These soils occur on relatively narrow flood plains and in slight depressions in the larger flood plains. They formed in alluvium washed from highly calcareous glacial drift under a forest of mixed hardwood trees.

The surface layer is dark grayish-brown silt loam about 7 inches thick. It is friable and easy to work.

The underlying material, to a depth of 60 inches, is dark grayish-brown silt loam. The upper part has gray mottles, the middle part has dark-brown mottles, and the lower part has yellowish-brown mottles.

Shoals soils are moderate in organic-matter content. The permeability is moderate, and the available water capacity is high. Crops on these soils generally do not need lime, but they do respond well to a complete fertilizer. Runoff is very slow, and the water table is seasonally high. These soils are flooded by water from creeks and by runoff water from adjacent uplands. Drainage is needed to insure good crop growth.

Where adequately drained and fertilized, Shoals soils are well suited to all crops commonly grown in the county. The Shoals soils on the flood plains of Wildcat Creek are used for crops, but the soils in narrow bottoms are used mostly for permanent pasture or are in trees.

Representative profile of Shoals silt loam, at the SE. corner, NW1/4 sec. 32, T. 24 N., R. 3 E., in a cultivated field:

Ap--0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable when moist; many, fine roots; neutral; clear, smooth boundary.

C1g--7 to 13 inches, dark grayish-brown (10YR 4/2) silt loam that has many, medium, distinct mottles of dark gray (N 4/0) and dark reddish brown (2.5Y 3/4); weak, medium, granular structure; friable when moist; neutral; clear, wavy boundary.

C2g--13 to 25 inches, dark grayish-brown (10YR 4/2) silt loam that has many, fine, faint mottles of dark brown (7.5YR 4/4); weak, medium, granular structure; friable when moist; calcareous; clear, wavy boundary.

C3g--25 to 60 inches, dark grayish-brown (10YR 4/2) silt loam that has common, fine, distinct mottles of yellowish brown (10YR 5/4) and dark brown (10YR 3/3); weak, medium, granular structure; friable when moist; calcareous.

The Ap horizon ranges from 5 to 8 inches in thickness and is very dark grayish brown, dark brown, or dark grayish brown. The reaction is neutral or slightly alkaline. Depth to mottling ranges from 5 to 13 inches. Thin layers of loam, sandy loam, and loamy sand may be present at a depth of 20 inches or more. Thick strata of gravel and sand are common below a depth of 48 inches in soils on the flood plain of Wildcat Creek.

Shoals silt loam (Sh).--This soil is nearly level and occupies areas in narrow stream bottoms and narrow strips on larger flood plains. The areas of this soil are generally elongated and range from 10 to 200 acres in size.

Included in mapping are small areas of soils that are not mottled above a depth of 13 inches. These soils occupy slightly elevated areas on the flood plains. Included in slight depressions adjacent to steep soils are a few narrow strips where the surface layer is dark and the subsoil is grayer than described as representative. Also included are small areas of Genesee silt loam.

The main hazards are flooding by streams and ponding by runoff water from uplands. In the narrow bottoms, a few, small areas are in corn. On the flood plains of Wildcat Creek, Shoals soils are used mostly for corn and only a few areas are used for woodland or permanent pasture. (Capability unit IIw-7)

The soils of Howard County are used mainly for growing cash grains and for raising livestock. This section explains how the soils can be managed for these main uses, and also how they can be managed as woodland and as habitat for wildlife.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use. (None of the soils in Howard County is in Class V.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, e, w, s, or c, to the class numeral, for example, IIe. The letter e shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty, or stony; and c, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-3 or IIIe-6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Howard County are described and suggestions for the use and management of the soils are given.

Management by Capability Units

In this subsection the soils of Howard County are placed in capability units and each unit is discussed. Each unit consists of soils that have about the same limitations, need about the same management, and respond to this management in about the same way. The discussions of the capability units describe the soil or soils in the units, name suitable crops or kinds of farming, and give suitable cropping systems and suggestions for management. The cropping systems given are only examples; other systems may be as well suited. Representatives of the Soil Conservation Service will help you select a cropping system suitable for your soils.

The names of the soil series represented in each capability unit are given. However, this does not mean that all the soils in the series are in the unit. To find the unit in which a given soil has been placed, refer to the "Guide to Mapping Units" at the back of this survey.

Approximately 60 percent of the acreage in the county is intensively cultivated. The main crops are corn, soybeans, wheat, oats, and tomatoes. Wetness is a hazard in more than 83 percent of the cultivated areas, and erosion is a hazard in about 12 percent. Only about 5 percent of the soils have few limitations that restrict their use for crops.

Artificial drainage is required on most cultivated soils. Covered drains, such as tile, can be installed beneath the surface to lower the water table, to serve as outlets for other tile drains, or to remove surface water. Surface drains are generally shallow graded ditches that carry surface water from depressional areas to an outlet. They can be crossed easily by farm machinery. Open drainage ditches are dug primarily as outlets for tile or surface drains. They are generally 4 to 8 feet deep and cannot be crossed by farm machinery.

Gently sloping to strongly sloping soils require management that controls runoff and erosion. Among the practices most common in the county are contour plowing, sodding waterways, and keeping tillage to a minimum. Tilth can be maintained and erosion can be controlled by planting crops for cover and green manure, and by utilizing crop residues.

All the cultivated soils in the county need fertilizer, and many need lime. Dark-colored soils in depressional areas and nearly level soils on bottom lands generally do not need lime. The kind and amount of fertilizer and lime to be applied should be determined by soil tests.

Capability Unit I-1

This unit consists of deep, well-drained, moderately permeable, medium-textured, nearly level soils of the Ockley and Russell series. These soils occur on upland till plains and outwash terraces. Runoff is very slow, and erosion is a slight hazard. The natural fertility and organic-matter content are moderate, and the available water capacity is high.

These soils are suited to the crops commonly grown in the county. Corn and soybeans are the main crops, but small grains and legume-grass mixtures are also grown.

The soils in this unit are easy to cultivate, and crops on them respond extremely well to good management. Management is needed to maintain organic-matter content and improve tilth. Effective practices are utilizing crop residues and growing crops for winter cover and for green manure.

Many cropping systems are suitable. These soils can be used to grow corn continuously.

Capability Unit I-2

Only Genesee silt loam is in this unit. This is a deep, well-drained, moderately permeable, medium-textured, nearly level soil that occurs on bottom lands. Runoff is very slow, and erosion generally is a slight hazard. Along streambanks erosion is a severe hazard. This soil is neutral or mildly alkaline. The natural fertility is high, the organic-matter content is moderate, and the available water capacity is high.

This soil is well suited to soybeans and pasture crops.

Management is needed to control wild grasses and weeds and to maintain organic-matter content and fertility. Minimum tillage is helpful in maintaining good tilth. Floods are a hazard late in winter and in spring, but crops are not normally damaged. Rye or ryegrass can be grown for cover and for green manure. A permanent cover of grass or trees on the banks of streams helps to reduce erosion. Corn can be grown continuously.

Capability Unit IIe-1

Only Miami silt loam, 2 to 6 percent slopes, eroded, is in this unit. This is a deep, well-drained, medium-textured soil that occurs on upland till plains. Runoff is slow, and erosion is a moderate hazard. The natural fertility and organic-matter content are moderate, and the available water capacity is high.

This soil is suited to the crops commonly grown in the county. The main crops are corn and soybeans, but small grains and legume-grass mixtures are also grown.

This soil is easy to cultivate, and crops on it respond well to good management. Management is needed to reduce erosion and maintain organic-matter content and fertility. Effective practices are leaving crop residues on the surface and growing crops for winter cover and green manure. Keeping tillage to a minimum, sodding waterways, and plowing on the contour also help reduce erosion (pl. I).

A suitable cropping system is a row crop followed by a small grain and then pasture. Row crops can be grown more often if management is intensive.

Capability Unit IIe-3

This unit consists of deep, well-drained, moderately permeable, medium-textured, gently sloping soils of the Ockley and Russell series. These soils occur on upland till plains and outwash terraces. They have a moderately fine textured subsoil that is overlain by about two feet of loess. Runoff is slow, and erosion is a moderate hazard. The natural fertility and organic-matter content are moderate, and the available water capacity is high.

The soils in this unit are suited to the crops commonly grown in the county. Corn and soybeans are the main crops, but small grains and legume-grass mixtures are also grown.

These soils are easy to cultivate, and crops on them respond well to good management. Management is needed to reduce erosion and maintain organic-matter content and fertility. Effective practices

are utilizing crop residues and growing crops for winter cover and green manure. Keeping tillage to a minimum, sodding waterways, and plowing on the contour also help reduce erosion.

A suitable cropping system is a row crop for 2 years followed by a small grain and then pasture. If management is intensive and includes minimum tillage and contour plowing, row crops can be grown more often.

Capability Unit IIe-6

Only Morley silt loam, 2 to 6 percent slopes, eroded, is in this unit. This is a deep, well-drained, medium-textured soil that occurs on upland till plains. The subsoil and underlying material are moderately fine textured. Runoff is slow, and erosion is a moderate hazard. Permeability is slow, and the available water capacity is high. The natural fertility and organic-matter content are moderate.

This soil is suited to the crops commonly grown in the county. Corn and soybeans are the main crops, but small grains and legume-grass mixtures are also grown.

This soil is easy to cultivate, and crops on it respond well to good management. Management is required to reduce erosion and maintain organic-matter content, fertility, and tilth. Effective practices are utilizing crop residues and growing crops for winter cover and green manure. Keeping tillage to a minimum, sodding waterways, and plowing on the contour also help reduce erosion.

A suitable cropping system is a row crop for 1 year followed by a small grain and then pasture for 2 years. If management is intensive and includes minimum tillage and contour plowing, row crops can be grown more often.

Capability Unit IIe-9

Only Fox silt loam, 2 to 6 percent slopes, eroded, is in this unit. This is a deep, well-drained, medium-textured soil that occurs on outwash terraces. Runoff is slow, and erosion is a moderate hazard. Drought is a hazard late in the growing season, particularly in dry years. Natural fertility is moderate or low, and the organic-matter content and available water capacity are moderate.

This soil is suited to all the small grains and pasture crops commonly grown in the county. It is especially well suited to alfalfa and other deep-rooted legumes. Varieties of corn and soybeans that mature early are also grown.

This soil is easy to cultivate, and crops on it respond well to good management. Management is required to reduce erosion and maintain organic-matter content, fertility, and tilth. Effective practices are utilizing crop residues and growing crops for winter cover and green manure. Keeping tillage to a minimum, sodding waterways, and plowing on the contour also help reduce erosion.

A suitable cropping system is a row crop followed by a small grain and then pasture for 2 years.

Capability Unit IIe-12

This unit consists of soils in the Blount and Crosby series. Some moderately eroded soils of the Miami series that are too small to manage separately are included with the Crosby soils. These soils are deep, somewhat poorly drained, medium-textured, and gently sloping. They occur on uplands. Runoff is slow, the available water capacity is high, and permeability is slow. The natural fertility and organic-matter content are moderate.

These soils are well suited to all crops commonly grown in the county. The main crops are corn and soybeans, but small grains, grass-legume mixtures, and tomatoes are also grown.

These soils are easy to cultivate. Management is needed to reduce erosion, drain excess water, and maintain organic-matter content and fertility. Effective practices are utilizing crop residues, growing crops for winter cover and green manure, keeping tillage to a minimum, and plowing on the contour. Artificial drainage is needed for crops.

Capability Unit IIw-1

This unit consists of deep, neutral, very poorly drained, medium-textured and moderately fine textured soils of the Brookston, Kokomo, Patton, and Pewamo series. These soils are nearly level and occur on upland till plains. The natural fertility, organic-matter content, and available water capacity are high. Permeability is moderately slow to very slow, and runoff is very slow or ponded. The water table is at or near the surface late in winter and in spring.

The soils in this unit are suited to all the crops commonly grown in the county. The main crops are corn and soybeans, but small grains, tomatoes, and legume-grass mixtures are also grown.

Management is needed to reduce wetness in these soils. If these soils are plowed when wet, clods form that are difficult to break down into a seedbed. These soils should be plowed only when the moisture content is favorable. A drainage system using tile, surface drains, and outlet ditches is needed for crops (pl. II). Crops planted for winter cover also help to remove excess water and make it possible to plow early in spring and to utilize fertilizer more effectively.

Many cropping systems are suitable. Corn can be grown continuously.

Capability Unit IIw-2

This unit consists of deep, somewhat poorly drained, medium-textured soils of the Blount, Crosby, and Fincastle series. These nearly level soils are on upland till plains. The natural fertility and organic-matter content are moderate, and the available water capacity is high. Runoff is very slow. Permeability is slow, and the water table is at or near the surface late in winter and early in spring.

These soils are suited to all the crops commonly grown in the county. The main crops are corn and soybeans, but small grains, grass-legume mixtures, and tomatoes are also grown.

Management is required to reduce wetness and maintain organic-matter content and fertility. Effective practices are keeping tillage to a minimum, utilizing crop residues, and planting crops for winter cover. A drainage system is needed for crops. Where drained, the soils warm up earlier in spring and can be plowed sooner.

Many cropping systems are suitable. Corn can be grown continuously.

Capability Unit IIw-7

Only Shoals silt loam is in this unit. This soil is deep, neutral or mildly alkaline, somewhat poorly drained, medium textured, and nearly level. It occurs on bottom lands. Runoff is very slow, and erosion is only a slight hazard. The natural fertility and organic-matter content are moderate. Permeability is moderate, and the available water capacity is high.

This soil is well suited to corn, soybeans, and pasture. Areas of this soil on narrow bottom lands that are dissected by streams are generally used for pasture, trees, or wildlife habitat.

This soil is easy to cultivate. Management is required to reduce wetness, control grass and weeds, and maintain organic-matter content. The water table is seasonally high, and floods occur late in winter and early in spring. Floods do not normally damage crops. Rye or ryegrass can be planted as a winter cover to protect the soil during floods. Tile and surface drains are required for crops. Where excess water is removed, the soil warms up earlier in spring. This permits earlier plowing and planting and more effective use of fertilizer. Tilth can be improved and weeds can be controlled by keeping tillage to a minimum.

Corn can be grown continuously if management is intensive and includes minimum tillage, artificial drainage, adequate additions of fertilizer, and weed control.

Capability Unit IIw-10

Only Linwood muck is in this unit. This is a deep, very poorly drained, nearly level organic soil that occupies depressions in the upland till plains. The water table is seasonally high. Runoff is very slow or ponded, permeability is moderate or moderately slow, and the available water capacity is high.

Where drained, this soil is well suited to corn and vegetable crops. Most areas of this soil are not drained and are covered by water-tolerant grasses that provide habitat for wetland wildlife.

Where this soil is used for crops, management is required to reduce wetness and control soil blowing. Effective practices are installing tile drains and growing crops for winter cover.

If management is intensive, corn can be grown continuously.

Capability Unit IIs-1

Only Fox silt loam, 0 to 2 percent slopes, is in this unit. This is a deep, well-drained, medium-textured soil that occurs on outwash terraces. The permeability and available water capacity are moderate, and runoff is very slow. The natural fertility and organic-matter content are moderate.

This soil is well suited to small grains and pasture. It is less well suited to corn and soybeans because drought may occur late in the growing season.

This soil is easy to cultivate. Management is required to maintain organic-matter content and improve tilth. Effective practices are utilizing crop residues, applying barnyard manure, and growing crops for winter cover and green manure. Drought is a hazard late in the growing season. This hazard can be overcome by irrigation.

A suitable cropping system is a row crop for 2 years followed by a small grain and then pasture.

Capability Unit IIIe-1

This unit consists of deep, well-drained, medium-textured and moderately fine textured soils of the Miami series. These soils are gently sloping and moderately sloping and occur on upland till plains. Permeability is moderate, and the available water capacity is high.

The gently sloping, moderately fine textured soils have low fertility and organic-matter content and are severely eroded. Runoff is medium, and erosion is a severe hazard. These soils have poor tilth. If they are plowed when wet, clods form that are extremely difficult to break down into a seedbed.

The moderately sloping, medium-textured soils have moderate fertility and organic-matter content. Runoff is medium, and erosion is a severe hazard. These soils have good tilth.

The soils in this unit are well suited to small grains and pasture. Corn and soybeans are also grown.

Crops on these soils respond well to good management. Management is required to reduce erosion, maintain fertility and organic-matter content, and improve the tilth of severely eroded soils. Effective practices are planting crops for winter cover and for green manure, utilizing crop residues, and applying barnyard manure on the severely eroded soils to improve tilth. The severely eroded soils should be plowed only when the moisture content is favorable to prevent the formation of large clods.

Capability Unit IIIe-6

Only Morley silty clay loam, 2 to 6 percent slopes, severely eroded, is in this unit. This is a deep, well-drained soil that occurs on upland till plains. This soil is moderately fine textured throughout. Permeability is slow, and runoff is medium. The natural fertility and organic-matter content are low, and the available water capacity is high.

This soil is well suited to small grains and pasture. Corn and soybeans are also grown.

Management is needed to reduce erosion, maintain organic-matter content and fertility, and improve tilth. Effective practices are planting crops for green manure, utilizing crop residues, and applying barnyard manure. If this soil is plowed when wet, clods form that are extremely hard to break down into a seedbed. To prevent the formation of clods, the soil should be plowed only when the moisture content is favorable.

Capability Unit IIIw-8

Only Carlisle muck is in this unit. This is a deep, very poorly drained, nearly level organic soil that occupies depressions in upland till plains and outwash terraces. The water table is seasonally high. Runoff is very slow or ponded, and permeability is moderately rapid. The available water capacity is high.

Where drained, this soil is well suited to corn and vegetable crops. Most areas of this soil are not drained and are covered by water-tolerant grasses that provide habitat for wetland wildlife (pl. II).

Where used for crops, this soil requires good management to reduce wetness and prevent soil blowing. Effective practices are planting crops for winter cover, utilizing crop residues, and installing tile drains.

If management is intensive, corn can be grown continuously.

Capability Unit IVe-1

Only Miami clay loam, 6 to 12 percent slopes, severely eroded, is in this unit. This is a deep, well-drained, moderately fine textured soil that occurs on upland till plains. Runoff is rapid, permeability is moderate, and the available water capacity is high. The natural fertility and organic-matter content are low.

This soil is well suited to small grains and legume-grass mixtures. Corn and soybeans can be grown occasionally.

Crops on this soil respond well to good management. If this soil is plowed when wet, clods form that are extremely difficult to break down into a seedbed. Management is required to reduce erosion, improve tilth, and maintain fertility and organic-matter content. Effective practices are planting crops for winter cover, applying barnyard manure, and utilizing crop residues. Terracing, sodding waterways, and keeping tillage to a minimum also help reduce erosion.

Capability Unit IVe-6

Only Morley silty clay loam, 6 to 12 percent slopes, severely eroded, is in this unit. This is a deep, well-drained soil that occurs on upland till plains. It is moderately fine textured throughout. Runoff is rapid, permeability is slow, and the available water capacity is high. The natural fertility and organic-matter content are low.

This soil is suited to small grains, legumes, and pasture. Where this soil occurs in areas large enough to be managed intensively, corn and soybeans can be grown occasionally.

This soil is difficult to cultivate. If the soil is plowed when wet, large clods form that are difficult to break down into a seedbed. This soil should be plowed only when the moisture content is favorable. Management is required to reduce erosion, maintain organic-matter content, and improve tilth (pl. III). Effective practices are utilizing crop residues, applying barnyard manure, and growing crops for winter cover. Also helpful in reducing erosion are terracing, keeping tillage to a minimum, and sodding waterways.

Row crops can be grown more often if management is intensive and includes terracing and minimum tillage to reduce erosion.

Capability Unit IVe-9

Only Fox soils, 6 to 12 percent slopes, severely eroded, are in this unit. These are deep, well-drained, moderately fine textured soils that occur on outwash terraces. The available water capacity is low, permeability is moderate, and runoff is medium. The natural fertility and organic-matter content are low.

These soils are well suited to alfalfa, grass-legume mixtures, and small grains. Where these soils occur in areas large enough to be managed intensively, corn or soybeans can be grown occasionally.

These soils are difficult to cultivate. Erosion is the main hazard, and drought is a severe hazard for row crops. Management is required to reduce erosion and maintain organic-matter content, fertility, and tilth. Effective practices are growing crops for winter cover, applying barnyard manure, and utilizing crop residues. Terracing, sodding waterways, and keeping tillage to a minimum also help reduce erosion.

Even if management is intensive, crops may be affected by drought late in the growing season, particularly in dry years.

Capability Unit VIe-1

Only Miami clay loam, 12 to 18 percent slopes, severely eroded, is in this unit. This is a deep, well-drained, moderately fine textured soil that occurs on upland till plains. The available water capacity is high, permeability is moderate, and runoff is very rapid. The natural fertility and organic-matter content are low.

This soil is suited to the grass and legume crops commonly grown in the county.

Management is needed to control erosion. Effective practices are maintaining a good cover of grass and legumes, controlling grazing, and liming and fertilizing pasture. Pasture should be seeded in narrow strips on the contour. Mulch tillage is beneficial.

Capability Unit VIIe-2

Only Hennepin loam, 25 to 60 percent slopes, is in this unit. This is a deep, well-drained, medium-textured soil that occurs on uplands. Permeability is moderate, and the available water capacity is high. Runoff is very rapid, and erosion is a very severe hazard where cover vegetation is removed.

This soil is not suited to cultivated crops. It is suited to trees and provides habitat for upland wildlife. Where well managed, good stands of tulip-poplar, black walnut, red oak, white oak, ash, and other hardwoods grow on this soil.

Management is required to control erosion. Effective practices are preventing livestock from grazing on this soil and maintaining cover vegetation.

Capability Unit VIIIs-2

This unit consists of Gravel pits, Quarries, and Made land. These land types provide some habitat for wildlife, but are not generally suited to crops or pasture without major reclamation. Some abandoned gravel pits are filled with water and are managed as fish ponds and for recreation. Some areas of Made land are used as refuse dumps.

Estimated Yields

In table 2 are listed the average yields per acre of corn, soybeans, wheat, oats, alfalfa hay, clover and grass that can be expected on each soil in the county under average and high levels of management. The yields are estimated averages for periods of 5 to 10 years. They are based on farm records, on interviews with farmers, with members of the staff of the Purdue Agricultural Experiment Station, and with others familiar with the agriculture of the county, and on direct observations made by soil scientists and district conservationists. Considered in making the estimates were the prevailing climate, the characteristics of the soils, and the influence of different kinds of management on the soils. Yields may increase in years to come, but these estimates are based on present crop production.

The yields in table 2 may not apply directly to specific tracts of land for any particular year, because the soils vary somewhat from place to place, management practices differ slightly from farm to farm, and the weather varies from year to year. Nevertheless, the estimates are as accurate a guide as can be obtained without further detailed and lengthy investigations. They are useful in showing the relative productivity of the soils and how soils respond to improved management.

Though not listed in the table, tomatoes are an important specialty crop of many farms in the northern and eastern parts of Howard County. Tomatoes are grown mostly on Blount, Brookston, Crosby, Fincastle, and Pewamo soils. Fields range from 10 to 30 acres in size. Where large amounts of a complete fertilizer are used, yields are as much as 22 to 26 tons per acre.

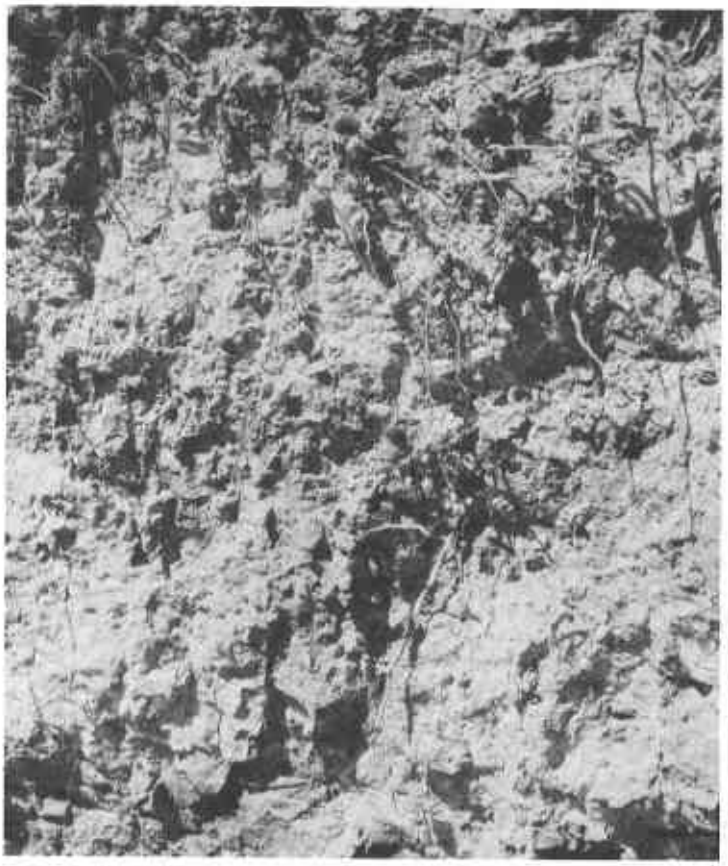
The average level of management needed for obtaining the yields of columns A consists of: (1) using cropping systems that maintain tilth and organic matter; (2) controlling erosion; (3) applying moderate amounts of fertilizers and lime as determined by soil tests; (4) returning most crop residues to the soil; (5) using conventional methods of plowing and tillage; (6) planting crop varieties that are generally adapted to the climate and the soils; (7) controlling weeds moderately well by tillage and spraying; and (8) installing drains in random places on wet soils.

The improved level of management needed for obtaining the yields in columns B consists of (1) using cropping systems that maintain tilth and organic matter; (2) controlling erosion; (3) applying large amounts of lime, phosphorus, potassium, and nitrogen fertilizer in amounts indicated by soil tests and recommended by the State Agricultural Experiment Station; (4) utilizing crop residues to the fullest extent in order to protect the soil and improve fertility; (5) keeping tillage to a minimum; (6) planting only the best-adapted crop varieties; (7) controlling weeds by tillage and spraying; and (8) installing a complete drainage system on wet soils.

TABLE 2.--ESTIMATED AVERAGE YIELDS OF PRINCIPAL CROPS UNDER TWO LEVELS OF MANAGEMENT

[In columns A are yields under average management; in columns B are yields under improved management. Absence of yield indicates that the soil is unsuitable for the crop or that the crop ordinarily is not grown on the soil. Hennepin loam, 25 to 60 percent slopes, Gravel pits, Made land, and Quarries are not rated because they are not suited to crops. Yields for Genesee and Shoals soils are for years when crops are not damaged by floods]

Soil	Corn		Soybeans		Wheat		Oats		Alfalfa hay		Clover grass	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Tons	Tons	Tons	Tons
Blount silt loam, 0 to 2 percent slopes	80	100	30	40	35	45	55	75	3.0	5.0	2.0	3.0
Blount silt loam, 2 to 4 percent slopes, eroded	75	95	25	35	35	45	55	75	3.0	5.0	2.0	3.0
Brookston silty clay loam	85	120	35	45	35	45	60	80	3.0	5.0	2.0	3.0
Carlisle muck	70	110	25	40	--	--	--	--	---	---	---	---
Crosby silt loam, 0 to 2 percent slopes	85	105	30	40	35	45	55	75	3.0	5.0	2.0	3.0
Crosby silt loam, 2 to 4 percent slopes, eroded	80	100	30	40	35	45	55	75	3.0	4.5	2.0	3.0
Crosby-Miami silt loams, 2 to 6 percent slopes, eroded	80	100	30	40	35	45	55	75	3.0	4.5	2.0	3.0
Fincastle silt loam	85	105	30	40	35	45	55	75	3.0	5.0	2.0	3.0
Fox silt loam, 0 to 2 percent slopes	60	75	20	28	30	43	40	55	2.5	4.0	2.0	3.0
Fox silt loam, 2 to 6 percent slopes, eroded	60	75	20	28	30	40	45	55	2.5	4.0	2.0	2.5
Fox soils, 6 to 12 percent slopes, severely eroded	35	40	15	20	20	25	40	50	2.0	3.5	1.5	2.5
Genesee silt loam	70	100	25	35	--	--	--	--	---	---	---	---
Kokomo silty clay loam	85	120	35	45	35	45	60	80	3.0	5.0	2.0	3.0
Kokomo silt loam, overwash	80	120	35	45	35	45	60	80	3.0	5.0	2.0	3.0
Linwood muck	70	110	25	38	--	--	--	--	---	---	---	---
Miami silt loam, 2 to 6 percent slopes, eroded	80	100	28	38	30	40	55	75	3.0	4.5	2.0	3.0
Miami clay loam, 2 to 6 percent slopes, severely eroded	55	85	20	30	25	35	50	65	2.7	4.5	1.8	2.7
Miami silt loam, 6 to 12 percent slopes, eroded	55	85	20	30	25	35	50	65	2.7	4.5	1.8	2.7
Miami clay loam, 6 to 12 percent slopes, severely eroded	45	70	16	24	20	30	45	65	3.0	4.0	1.5	2.0
Miami clay loam, 12 to 18 percent slopes, severely eroded	--	--	--	--	15	25	35	50	2.0	3.0	1.3	2.2
Morley silt loam, 2 to 6 percent slopes, eroded	70	90	25	30	30	40	45	60	2.5	4.0	2.0	3.0
Morley silty clay loam, 2 to 6 percent slopes, severely eroded	45	75	20	25	25	30	40	60	2.5	3.5	1.5	2.5
Morley silty clay loam, 6 to 12 percent slopes, severely eroded	40	65	15	20	18	28	35	45	2.5	3.0	1.5	2.5
Ockley silt loam, 0 to 2 percent slopes	85	100	30	40	37	45	60	80	3.5	5.0	2.5	3.0
Ockley silt loam, loamy substratum, 0 to 2 percent slopes	80	100	30	40	37	45	60	80	3.5	5.0	2.5	3.0
Ockley silt loam, 2 to 6 percent slopes, eroded	75	85	25	35	32	40	50	65	3.0	5.0	2.0	3.0
Ockley silt loam, loamy substratum, 2 to 6 percent slopes, eroded	70	85	28	38	35	45	55	75	3.0	4.5	2.0	3.0
Patton silty clay loam, loamy substratum	85	120	35	45	35	45	60	80	3.0	5.0	2.0	3.0
Patton silty clay loam, occasionally flooded	70	95	25	40	25	28	--	--	---	---	---	---
Pewamo silty clay loam	80	115	30	40	35	45	60	80	3.0	5.0	2.0	3.0
Russell silt loam, 0 to 2 percent slopes	85	105	33	40	37	45	60	80	3.5	5.0	2.5	3.0
Russell silt loam, 2 to 6 percent slopes, eroded	80	100	25	35	32	40	50	65	3.0	5.0	2.0	3.0
Shoals silt loam	70	90	25	35	15	25	30	45	2.0	2.5	1.5	2.5



Profile of Fincastle silt loam.

Profile of Fox silt loam.

Sodded waterway on Miami silt loam, 2 to 6 percent slopes, eroded.

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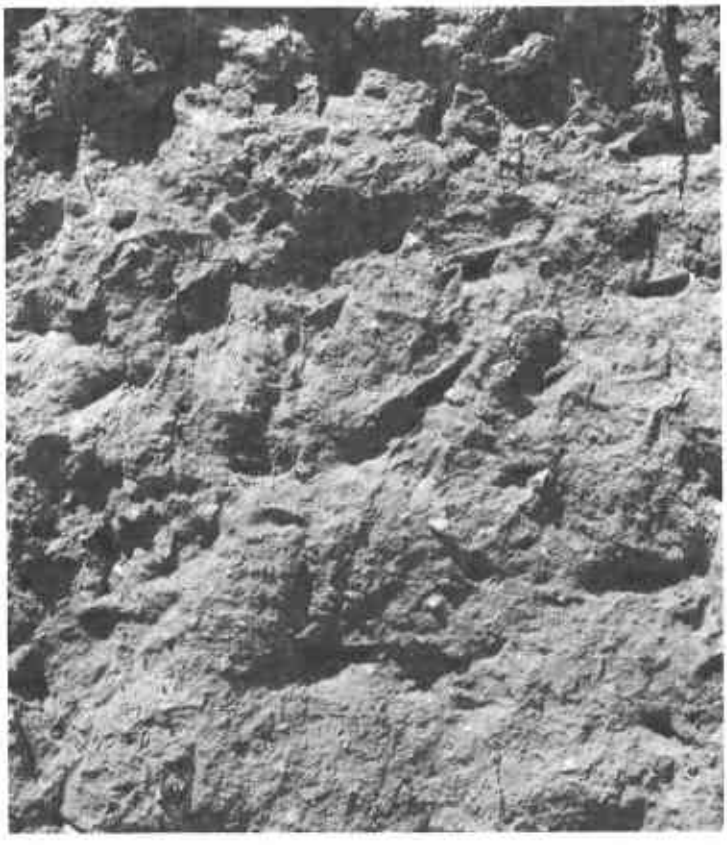
Drainage ditch on Brookston silty clay loam.

Undrained Carlisle muck provides habitat for wetland wildlife.

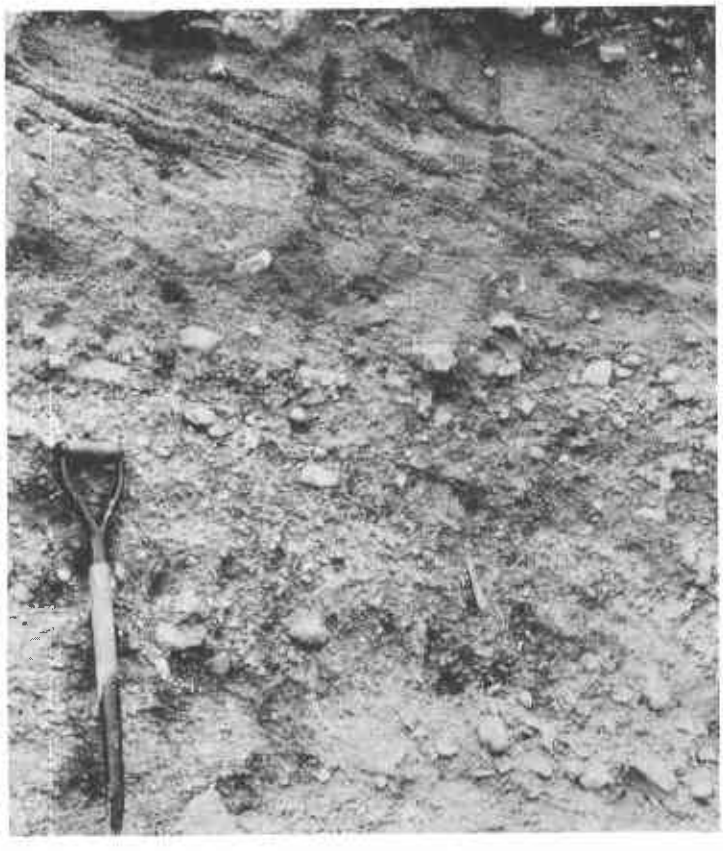
Gully erosion on cultivated Morley silty clay loam, 6 to 12 percent slopes, severely eroded.

Woodlot on Brookston silty clay loam and Fincastle silt loam.

Shallow impoundment and wetland plants provide wildlife habitat.



Wisconsin loam glacial till is a compact structureless mixture of sand, silt, clay, and stones.



Glacial outwash is cross bedded. Note the abrupt boundary between unweathered till above and stratified gravel and sand below.

Woodland[2/]

Dense stands of hardwoods originally covered nearly all of Howard County. In most parts of the county these stands were cleared because the soils were suitable for farming. Development of residential and industrial areas, recreational facilities, and highways has further reduced the woodland of the county. Areas now in trees have little commercial value, but are important for erosion control, recreation, and wildlife.

Moderately sloping to very steep soils adjacent to creeks generally support mixed stands of red oak, white oak, white ash, sugar maple, tulip-poplar, black walnut, and hickory trees. Among these are soils of the Miami, Hennepin, and Morley series. Areas of somewhat poorly drained and very poorly drained, level and nearly level soils also are in trees. Most of these soils are in the Brookston, Pewamo, Crosby, Fincastle, and Shoals series (pl. III).

Trees suitable for planting are listed in table 3, and suitable shrubs in table 4. The tables show the characteristics of the trees and shrubs and indicate their suitability, by soil groups, for windbreaks and screen plantings, for beautification, hedges, and shade, and for erosion control and roadcuts.

The soils of the county have been grouped according to their suitability for specified plantings of trees and shrubs. There are five groups. The "Guide to Mapping Units" at the back of this survey shows the group to which each soil belongs. Gravel pits, Made land, and Quarries are not assigned to any tree and shrub suitability group because their characteristics are too variable.

2/ Prepared with the assistance of JOHN O. HOLWAGER, woodland conservationist, Soil Conservation Service.

TABLE 3.--TREE PLANTINGS

[Dashes indicate that, on the soils of the particular group, the tree is not suitable for any of the uses specified]

Tree	Characteristics of tree	Suitable uses for trees by soil suitability group				
		Group 1	Group 2	Group 3	Group 4	Group 5
Arborvitae------	Ultimate height of 30 to 40 feet; medium growth rate.	Windbreaks and screens; hedges.	Windbreaks and screens; hedges.	----------	----------	----------
Basswood--------	Ultimate height of 60 to 70 feet; rapid growth rate; shade tolerant.	----------	----------	----------	----------	Shade.
Blackgum--------	Ultimate height of 60 to 70 feet; medium growth rate; shade tolerant.	----------	Beautification; shade.	Beautification; shade.	----------	----------
Black locust----	Ultimate height of 40 to 50 feet; rapid growth rate.	----------	----------	----------	----------	Beautification; shade; eroded areas and roadcuts.
Canada hemlock--	Ultimate height of 70 to 80 feet; medium growth rate; shade tolerant.	----------	----------	Windbreaks and screens; beautification; hedges.	----------	----------
Cottonwood------	Ultimate height of 50 to 60 feet; rapid growth rate.	Shade-------	Windbreaks and screens; shade.	----------	----------	----------

TABLE 3.--TREE PLANTINGS--Continued

Tree	Characteristics of tree	Suitable uses for trees by soil suitability group				
		Group 1	Group 2	Group 3	Group 4	Group 5
Crabapple-------	Ultimate height of 20 to 30 feet; rapid growth rate.	----------	----------	----------	Windbreaks and screens; beautification.	----------
European larch--	Ultimate height of 50 to 60 feet; medium growth rate.	Beautification.	----------	----------	----------	----------
Flowering dogwood.	Ultimate height of 10 to 30 feet; medium growth rate; shade tolerant.	----------	----------	----------	Windbreaks and screens; beautification; eroded areas and roadcuts.	Windbreaks and screens; beautification; eroded areas and roadcuts.
Ginko----------	Ultimate height of 70 to 80 feet; rapid growth rate.	----------	----------	----------	Beautification.	----------
Hackberry-------	Ultimate height of 50 to 60 feet; slow growth rate; shade tolerant.	----------	----------	----------	----------	Shade.
Horse chestnut--	Ultimate height of 60 to 70 feet; rapid growth rate; shade tolerant.	----------	----------	----------	----------	Beautification.
Jack pine-------	Ultimate height of 30 to 40 feet; rapid growth rate.	----------	----------	----------	----------	Windbreaks and screens; eroded areas and roadcuts.
Kentucky coffeetree.	Ultimate height of 60 to 70 feet; rapid growth rate.	----------	----------	----------	----------	Beautification; shade; eroded areas and roadcuts.
Lombardy poplar-	Ultimate height of 30 to 40 feet; rapid growth rate.	Beautification.	----------	----------	----------	----------
Norway maple----	Ultimate height of 60 to 70 feet; medium growth rate; shade tolerant.	----------	----------	----------	----------	Shade.
Norway spruce---	Ultimate height of 40 to 50 feet; slow growth rate; shade tolerant.	Windbreaks and screens; shade.	Windbreaks and screens; shade.	Windbreaks and screens; shade.	----------	----------
Pin oak---------	Ultimate height of 60 to 70 feet; rapid growth rate.	Beautification.	Beautification.	Beautification.	----------	----------

TABLE 3.--TREE PLANTINGS--Continued

Tree	Characteristics of tree	Suitable uses for trees by soil suitability group				
		Group 1	Group 2	Group 3	Group 4	Group 5
Redbud	Ultimate height of 20 to 30 feet; medium growth rate.	---	---	---	Windbreaks and screens; beautification; eroded areas and roadcuts.	Windbreaks and screens; beautification; eroded areas and roadcuts.
Red maple	Ultimate height of 50 to 60 feet; rapid growth rate; shade tolerant.	Shade	Shade	Shade	---	---
Red pine	Ultimate height of 50 to 60 feet; rapid growth rate.	---	---	---	Windbreaks and screens; eroded areas and roadcuts.	Windbreaks and screens; eroded areas and roadcuts.
Scarlet oak	Ultimate height of 60 to 70 feet; medium growth rate.	---	---	---	Beautification.	---
Serviceberry	Ultimate height of 20 to 30 feet; medium growth rate; shade tolerant.	---	---	---	Windbreaks and screens; beautification.	---
Silver maple	Ultimate height of 50 to 60 feet; rapid growth rate; shade tolerant.	Shade	---	---	---	---
Sugar maple	Ultimate height of 60 to 70 feet; slow growth rate; shade tolerant.	---	---	---	Beautification; shade.	---
Sweetgum	Ultimate height of 70 to 80 feet; rapid growth rate.	---	---	Beautification.	---	---
Thornless honeylocust.	Ultimate height of 60 to 70 feet; rapid growth rate.	---	---	Beautification; eroded areas and roadcuts.	Beautification; eroded areas and roadcuts.	Beautification; eroded areas and roadcuts.
Tulip-poplar	Ultimate height of 70 to 80 feet; rapid growth rate.	---	---	---	Beautification; shade.	---
Weeping willow	Ultimate height of 40 to 50 feet; rapid growth rate.	Beautification.	---	---	---	---

TABLE 3.--TREE PLANTINGS--Continued

Tree	Characteristics of tree	Suitable uses for trees by soil suitability group				
		Group 1	Group 2	Group 3	Group 4	Group 5
White birch------	Ultimate height of 60 to 70 feet; medium growth rate; shade tolerant.	Windbreaks and screens; beautification.	Windbreaks and screens; beautification.	----------	----------	----------
White pine--------	Ultimate height of 60 to 70 feet; rapid growth rate.	----------	Windbreaks and screens; shade; eroded areas and roadcuts.	Windbreaks and screens; shade; eroded areas and roadcuts.	Windbreaks and screens; shade; eroded areas and roadcuts.	----------
White spruce-----	Ultimate height of 40 to 50 feet; slow growth rate; shade tolerant; does not grow well where fully exposed to sunlight.	Windbreaks and screens.	----------	----------	----------	----------
Willow-----------	Ultimate height of 30 to 40 feet; rapid growth rate.	Shade------	----------	----------	----------	----------

TABLE 4.--SHRUB PLANTINGS

[Dashes indicate that, on the soils of the particular group, the shrub is not suitable for any of the uses specified]

Shrub	Characteristics of shrub	Suitable uses for shrubs by soil suitability group				
		Group 1	Group 2	Group 3	Group 4	Group 5
Amur honeysuckle--	Ultimate height of 8 to 16 feet; rapid growth rate.	----------	Windbreaks and screens; beautification; hedges.	Windbreaks and screens; beautification; hedges.	----------	Windbreaks and screens; beautification.
Arrowwood---------	Ultimate height of 8 to 10 feet; slow growth rate; shade tolerant.	----------	----------	Hedges; eroded areas and roadcuts.	----------	----------
Autumn-olive------	Ultimate height of 8 to 10 feet; rapid growth rate.	----------	----------	----------	Windbreaks and screens; beautification; hedges; eroded areas and roadcuts.	Windbreaks and screens; beautification; hedges; eroded areas and roadcuts.

TABLE 4.--SHRUB PLANTINGS--Continued

Shrub	Characteristics of shrub	Suitable uses for shrubs by soil suitability group				
		Group 1	Group 2	Group 3	Group 4	Group 5
Blackhaw---------	Ultimate height of 8 to 10 feet; medium growth rate; shade tolerant.	----------	----------	----------	----------	Windbreaks and screens; beautification; hedges; eroded areas and roadcuts.
Blue arctic willow.	Ultimate height of 6 to 8 feet; medium growth rate.	Beautification; hedges.	----------	----------	----------	----------
Elderberry-------	Ultimate height of 6 to 10 feet; rapid growth rate.	----------	Windbreaks and screens.	----------	----------	----------
Flowering-quince-	Ultimate height of 6 to 8 feet; medium growth rate.	----------	----------	Windbreaks and screens; beautification; hedges; eroded areas and roadcuts.	----------	----------
Forsythia--------	Ultimate height of 7 to 9 feet; rapid growth rate.	----------	----------	Beautification; hedges; eroded areas and roadcuts.	Beautification; hedges; eroded areas and roadcuts.	----------
Gray dogwood-----	Ultimate height of 4 to 8 feet; medium growth rate.	----------	Windbreaks and screens; hedges; eroded areas and roadcuts.	----------	----------	----------
Highbush cranberry.	Ultimate height of 6 to 10 feet; slow growth rate rate; shade tolerant.	----------	Beautification; hedges.	Beautification; hedges.	----------	----------
Mapleleaf viburnum.	Ultimate height of 6 to 8 feet; medium growth rate; shade tolerant; does not grow well where fully exposed to sunlight.	----------	----------	----------	Hedges-----	----------
Multiflora rose.	Ultimate height of 8 to 10 feet; rapid growth rate; shade tolerant.	----------	----------	----------	Windbreaks and screens; hedges.	----------

TABLE 4.--SHRUB PLANTINGS--Continued

Shrub	Characteristics of shrub	Suitable uses for shrubs by soil suitability group				
		Group 1	Group 2	Group 3	Group 4	Group 5
Persian lilac----	Ultimate height of 8 to 10 feet; medium growth rate.	----------	----------	----------	Windbreaks and screens; beautification.	----------
Purple-osier willow.	Ultimate height of 8 to 10 feet; rapid growth rate.	Windbreaks and screens.	----------	----------	----------	----------
Red-osier dogwood.	Ultimate height of 5 to 8 feet; medium growth rate; shade tolerant.	----------	Windbreaks and screens; eroded areas and roadcuts.	Windbreaks and screens.	----------	----------
Siebold viburnum-	Ultimate height of 20 to 30 feet; rapid growth rate.	----------	----------	----------	Windbreaks and screens; beautification; hedges.	----------

Wildlife [3/]

Wildlife is not plentiful in Howard County because most soils are intensively cultivated. Little native cover for upland game grows, except on the escarpments along Wildcat Creek and its tributaries. Most cover for game is on Hennepin loam, 25 to 60 percent slopes.

Table 5 shows the suitability of the soils, by groups and series, for various kinds of vegetation that provide habitat for wildlife, for water impoundments and fish ponds, and for open-land, woodland, and wetland wildlife. Gravel pits, Made land, and Quarries are not rated in the table because their characteristics are too variable. In the following paragraphs, the wildlife in Howard County is briefly described and the terms used in table 5 are defined.

The population of bobwhite quail averages one covey per square mile in the county. Rabbits are few, except along Wildcat Creek west of Kokomo. Most rabbits and quail live in woody cover on soils that are in wildlife suitability group 4. Some live in wooded areas on the edges of wet Brookston soils that are in wildlife suitability group 1.

Fox squirrels, red squirrels, and raccoons live in small wooded areas of soils in wildlife groups 1, 2, and 4. These soils are adjacent to streams, on escarpments, and in flat, poorly drained areas. Pheasant and deer are rare, but red fox and opossum are common throughout the county. Mink and muskrat live in open drainage ditches on level Brookston, Pewamo, and Blount soils. They also live along streams and in small marshes. Ducks also live in marshes. In fall, doves migrate through the county in large flocks.

Bass, redear, bluegill, and channel catfish are stocked in farm ponds. Fish production is as much as 150 pounds per surface acre of water in ponds on soils of wildlife suitability group 1.

Open-land wildlife consists of birds and mammals that normally frequent areas of cultivated crops, hay, and pasture, and areas that are overgrown by native grasses, herbs, and shrubs. Examples are quail, meadowlarks, rabbits, and red fox.

Woodland wildlife consists of birds and mammals that normally frequent areas of hardwood trees, coniferous trees, and shrubs. Examples are woodpeckers, nuthatches, vireos, warblers, squirrels, raccoons, and woodchucks.

Wetland wildlife consists of birds and mammals that normally frequent wet areas, such as ponds, marshes, and swamps. Examples are waterfowl, rails, the kingfisher, and muskrat.

Vegetation determines what kinds of wildlife live in a given area. Among the grain and seed crops valuable for wildlife are cultivated sorghum, corn, millet, soybeans, buckwheat, wheat, barley, and oats. Among the grasses and legumes are cultivated sericea lespedeza, alfalfa, alsike clover, ladino

[3/] Prepared by JAMES D. McCALL, biologist, Soil Conservation Service.

TABLE 5.--SUITABILITY OF SOILS FOR ELEMENTS OF WILDLIFE HABITAT AND FOR KINDS OF WILDLIFE

Wildlife group and soil series	Elements of wildlife habitat--							Kinds of wildlife--		
	Grain and seed crops	Grasses and legumes	Hardwood plants 1/	Coniferous plants 2/	Wetland plants	Shallow impoundments	Fish ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Group 1:										
Blount----	Well suited.	Well suited.	Well suited.	Poorly suited.	Suited---	Suited---	Suited---	Suited---	Suited---	Suited.
Brookston-	Well suited.	Well suited.	Poorly suited.	Well suited.	Well suited.	Well suited.	Well suited.	Suited---	Suited---	Suited.
Crosby----	Well suited.	Well suited.	Well suited.	Poorly suited.	Suited---	Suited---	Suited---	Suited---	Suited---	Suited.
Fincastle-	Well suited.	Well suited.	Well suited.	Poorly suited.	Suited---	Suited---	Suited---	Suited---	Suited---	Suited.
Kokomo----	Well suited.	Well suited.	Poorly suited.	Well suited.	Well suited.	Well suited.	Well suited.	Suited---	Suited---	Suited.
Patton----	Well suited.	Well suited.	Poorly suited.	Well suited.	Well suited.	Well suited.	Well suited.			
Pewamo----	Well suited.	Well suited.	Poorly suited.	Well suited.	Well suited.	Well suited.	Well suited.	Suited---	Suited---	Suited.
Group 2:										
Genesee---	Well suited.	Well suited.	Well suited.	Poorly suited.	Poorly suited.	Poorly suited.	Poorly suited.	Well suited.	Suited---	Well suited.
Shoals----	Well suited.	Well suited.	Well suited.	Poorly suited.	Suited---	Poorly suited.	Poorly suited.	Well suited.	Suited---	Well suited.
Group 3:										
Fox-------	Suited---	Well suited.	Well suited.	Suited----	Unsuited.	Unsuited.	Unsuited.	Suited---	Well suited.	Unsuited.
Ockley----	Suited---	Well suited.	Well suited.	Poorly suited.	Unsuited.	Unsuited.	Unsuited.	Suited---	Well suited.	Unsuited.
Group 4:										
Hennepin--	Unsuited.	Unsuited.	Well suited.	Poorly suited.	Unsuited.	Unsuited.	Unsuited.	Suited---	Well suited.	Unsuited.
Group 5:										
Miami----	Suited to poorly suited.	Suited to well suited.	Well suited.	Poorly suited.	Unsuited.	Unsuited.	Poorly suited.	Suited---	Poorly suited.	Unsuited.
Morley-----	Suited to poorly suited.	Suited to well suited.	Well suited.	Poorly suited.	Unsuited.	Unsuited.	Poorly suited.	Suited---	Poorly suited.	Unsuited.
Russell---	Suited to well suited.	Well suited.	Well suited.	Poorly suited.	Unsuited.	Unsuited.	Poorly suited.	Suited---	Poorly suited.	Unsuited.
Group 6:										
Carlisle---	Poorly suited.	Suited---	Unsuited.	Unsuited.	Well suited.	Well suited.	Suited---	Poorly suited.	Poorly suited.	Well suited.
Linwood---	Poorly suited.	Suited---	Unsuited.	Unsuited.	Well suited.	Well suited.	Suited---	Poorly suited.	Poorly suited.	Well suited.

1/ Water-tolerant hardwood trees and shrubs are well suited to undrained Brookston, Kokomo, Patton, and Pewamo soils, and they are suited to undrained Blount, Crosby, and Fincastle soils.

2/ Coniferous trees and shrubs are unsuited to undrained Brookston, Kokomo, Patton, and Pewamo soils.

clover, red clover, tall fescue, bromegrass, bluegrass, native switchgrass, partridgepeas, Desmodium (beggarticks), whitetop asters, and various kinds of lespedeza

The hardwood trees and shrubs that provide wildlife habitat are oak, walnut, hickory, wild cherry, sumac, flowering dogwood, hazelnut, shrub lespedeza, multiflora rose, autumn-olive, and bush honeysuckle. Among the water-tolerant shrubs and trees valuable for wildlife are red-osier dogwood, silky dogwood, aspen, pin oak, and soft maple. Important coniferous shrubs and trees are red pine, white pine, and Norway spruce.

Wetland plants that provide food and cover for waterfowl and fur-bearing animals in the county are mainly annuals or biennials. Among the wetland plants are smartweed, barnyard grass, three-square, bulrush, spikerush, pondweed, duckweed, and sedge. Wetland plants used primarily for cover are cattail, arrow-arum, pickerelweed, buttonbush, waterwillow, and spatterdock (pl. III).

In table 5 soils are evaluated for shallow impoundments that hold less than 2 feet of water, and for dug or impounded fish ponds that are at least 8 feet deep.

ENGINEERING PROPERTIES OF THE SOILS

This section lists and describes the properties of the soils that are important for engineering uses. Of special interest to engineers are soil properties that affect the construction and maintenance of roads, airports, pipelines, buildings, facilities for water storage, erosion-control structures, drainage systems, and sewage-disposal systems. Among the properties affecting engineering uses are grain size, permeability, frost-heave potential, shrink-swell characteristics, seasonal water table, depth to bedrock, shear strength, compaction characteristics, and stability. The topographic position of a given soil may also be significant.

The information in this survey can be used to:

1. Make studies of soil and land use that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary evaluations of soil and ground conditions that will aid in selecting highway and airport locations and in planning detailed soil surveys at the selected locations.
3. Assist in designing drainage systems, farm ponds and other structures for soil and water conservation.
4. Locate possible sources of sand and gravel.
5. Correlate performance of structures with soil mapping units and, thus, develop information that can be useful in designing and maintaining new structures.
6. Determine the suitability of soil units for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

The information in this survey will not eliminate the need for sampling and testing soils on the site to determine their suitability for specific engineering purposes, but the interpretations can be used to select sites that may be suitable and to plan detailed field investigations.

Some terms used by the soil scientist may be unfamiliar to the engineer, and some terms have special meanings in soil science. Most of these terms, as well as other special terms used in this survey, are defined in the Glossary. Information useful for engineering can be obtained from the soil map and from other parts of this survey, particularly the section "Descriptions of the Soils" and "Formation and Classification of Soils."

The data in table 6 are from laboratory tests. The estimates for the soils listed in tables 7 and 8 were made by comparing those soils with the soils tested. At many construction sites, variations in soil characteristics may occur within the depth of the proposed excavations, and several soils may occur within short distances. For these reasons, laboratory data on engineering properties of the soils at the construction site should be obtained before engineering work is planned in detail.

Engineering Classification Systems

Two systems for classifying soils are in general use among engineers. They are the system approved by the American Association of State Highway Officials (AASHO) (1) and the Unified system adopted by the Corps of Engineers, U.S. Army (8). Both classification systems are shown in tables 6 and 7 and are briefly described here.

AASHO Classification.--The American Association of State Highway Officials has developed a classification based on the field performance of soil materials. In this system soils are classified in seven principal groups. The groups range from A-1, consisting of gravelly soils of high bearing capacity, to A-7, consisting of clay soils of low strength when wet. Peat, muck, or other highly organic soils are not included in this classification because their use as a construction material or foundation material should be avoided.

Within each of the principal groups, the relative engineering value of the soil material is indicated by a group index number. Group indexes range from 0 for the best materials to 20 for the

poorest. The group index number for the horizons of the soils tested is shown in parentheses after the soil group symbol in the next to last column in table 6.

Unified Classification.--This classification is based on the identification of soils according to their texture, plasticity, and liquid limit. The three major groupings are coarse-textured soils, fine-textured soils, and organic soils. The soils are divided into 15 classes: 8 classes for coarse-grained material (GW, GP, GM, GC, SW, SP, SM, SC), 6 classes for fine-grained material (ML, CL, OL, MH, CH, OH), and 1 class for highly organic material (Pt).

Soil Test Data

Test data for three soils in Howard County are given in table 6. Samples were taken from selected layers of each soil. These samples were tested according to standard procedures in the laboratories of the Joint Highway Research Project, Purdue University, under the sponsorship of the Bureau of Public Roads. The tests were made so that information could be obtained that would assist in the evaluation of the soils for engineering uses. The samples do not represent the entire range of soil properties in Howard County, or even within the three soil series sampled, but the results from the tests have been used as a guide in estimating the engineering properties of the soils in the county.

Both the AASHO and Unified classifications are listed in table 6. They are based on data obtained by mechanical analysis and from tests to determine the liquid and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods. The grain size of sand, silt, and clay indicated by engineers is not equivalent to the grain size used by soil scientists. For example, clay, to soil scientists, refers to mineral grains less than 0.002 millimeters in diameter, whereas engineers frequently define the size of clay as less than 0.005 millimeters in diameter.

The liquid-limit and plastic-limit tests on the soil samples measure the effect of water on the consistency of soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid state to a plastic state. As the moisture content is further increased, the material changes from the plastic state to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

Table 6, under "Moisture-density," gives data on the relationship between the moisture content and the compacted density of the soil as determined by the standard methods described in AASHO Designation: T 99-57. If soil material is compacted at successively higher moisture content, assuming that the same amount of force is used in compacting the soil, the density of the compacted material will increase until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The oven-dry weight, in pounds per cubic foot of the soil at optimum moisture content, is the maximum dry density. Data on the relationship of moisture to density are important in planning earthwork because generally the soil is most stable if it is compacted to its maximum dry density when it is approximately at the optimum moisture content.

Estimated Properties of the Soils

Table 7 gives estimates of the physical and chemical properties of the soils to a depth of 5 feet or less. The properties of Gravel pits, Made land, and Quarries are too variable to rate. Because actual tests were made on only the soils listed in table 6, it was necessary to estimate the engineering properties of the rest of the soils. In making these estimates, the soil scientists compared the untested soils with the tested soils and used the knowledge gained from working with similar soils in other areas. The estimates are not a substitute for tests at sites selected for construction.

Depth to the major horizons is given in table 7. Depth to bedrock generally is more than 60 inches in all soils of the county and is not listed in the table.

The estimates of the percentage of material passing sieves are given to the nearest 5 percent. The percentage of material passing the 200 sieve generally indicates the amount of very fine sand, silt, and clay in a soil.

Permeability refers to the movement of water downward through undisturbed soil material. It was estimated largely on the basis of texture, structure, and consistence. The available water capacity is the capacity of the soil to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The highest level to which the seasonal water table rises is the one given.

The estimated reaction of each major horizon of the soils is given in pH values. These estimates apply to soil that is undisturbed and that has not been limed.

Frost potential rates the degree that frost action affects the soil. Frost action is a major consideration if (1) water is present in the soil; (2) low temperature exists long enough to permeate the soil; and (3) ice lenses are likely to form and cause the soil to lose strength when the lenses thaw after freezing.

Shrink-swell potential indicates the volume change to be expected of the soil material with

changes in moisture content. It is estimated mainly on the basis of the amount and kind of clay in the soil.

Engineering Interpretations of the Soils

In table 8 are listed features that affect the suitability of soils for various purposes. Topsoil refers to soil material that is used to topdress slopes, embankments, and lawns. The rating is based mainly on soil texture and organic-matter content. The suitability of soils as a source of sand and gravel is rated only to a depth of 5 to 7 feet. Because sand and gravel occur at variable depths in the soils of a series, test pits must be dug to determine the extent and accessibility of deposits in a given area. In rating the suitability of soil material for use as borrow for road subgrades, the subsoil and substratum are rated separately if they have significantly different characteristics.

The suitability of soils as foundations for buildings no more than three stories high is determined mainly by the characteristics of the substratum. In determining suitability for highway location, the entire profile of undisturbed soil without artificial drainage is evaluated.

Among the soil features affecting sewage lagoons, septic tank filter fields, and reservoir areas are permeability, slope, organic-matter content, depth to bedrock, and the hazard of flooding. The suitability of soil material for use in embankments to impound water on the surface is determined mainly by the clay content and shrink-swell potential. Features that affect agricultural drainage are texture, permeability, seasonal water table, and impermeable layers in the soil.

Properties of Gravel pits, Made land, and Quarries are not rated in table 7 because they are too variable.

TABLE 6.--ENGINEERING

[Tests performed by Purdue University in cooperation with the Indiana State Highway Department and the Association of State

Soil name and location	SCS report No.	Depth	Moisture-density 1/		Mechanical analysis 2/	
			Maximum dry density	Optimum moisture	Percentage passing sieve--	
					3/4 in.	No. 10 (2.0 mm.)
	S63 Ind-34	Inches	Lb. per cu. ft.	Percent		
Brookston silty clay loam:						
SW¼NE¼ sec. 5, T. 23 N., R. 4 E.	3-1	0-8	96	24	100	98
	3-2	31-40	106	18	100	97
	3-3	46-66	127	10	100	94
Crosby silt loam:						
NW¼SW¼ sec. 23, T. 23 N., R. 4 E.	1-1	0-7	103	20	100	99
	1-2	12-17	100	21	---	100
	1-3	31-42	123	12	100	90
Miami silt loam:						
NE¼NE¼ sec. 8, T. 24 N., R. 4 E.	5-1	0-7	105	19	100	99
	5-2	7-17	110	17	100	92
	5-3	32-56	131	10	100	86

1/ Based on AASHO Designation: T 99-57, Method A.

2/ Mechanical analyses according to the AASHO Designation: T 88-57 (1). Results by this procedure frequently differ from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is

Use and Management of the Soils for Recreation

The degree and kind of limitation of the soils for recreational uses are given in table 9. Slight limitations are easy to overcome, whereas moderate limitations can be overcome by careful planning and good management. Severe limitations indicate that careful planning and intensive management are required, and very severe limitations indicate that the soil generally is not practical to use without major reclamation or very expensive site preparation.

Intensive play areas, such as baseball diamonds and football fields, are subject to much foot traffic and generally require good drainage and a surface that is nearly level and firm. Also, intensive play areas should be free of rocks and rock outcrop. Without much preparation, campsites should be suitable for tents and trailers and for outdoor living for a period of at least one week. Soils are rated only for use as golf fairways, because traps and greens generally are constructed from transported soil material. Slopes, trafficability, and erodibility are considered in determining the degree of limitation of soils used for golf fairways, campsites, extensive play areas, and picnic areas. Trafficability refers to the difficulty or ease with which people can move about on foot, on horseback, or in a small vehicle, such as a golf cart. Seasonal wetness, flooding, ponding, and erosion affect all the uses, especially the installation of warming huts, sanitary facilities, and maintenance sheds. For more information about soil properties affecting these latter uses, refer to tables 7 and 8.

Properties of Gravel pits, Made land, and Quarries were not rated in table 9 because they are too variable.

TEST DATA

Bureau of Public Roads (BPR). Tests were performed in accordance with standard procedures of the American Highway Officials (AASHO)]

Mechanical analysis 2/--Cont.						Liquid limit	Plasticity index	Classification	
Percentage passing sieve--Cont.		Percentage smaller than--						AASHO	Unified 3/
No. 40 (2.0 mm.)	No. 200 (0.74 mm.)	0.05 mm.	0.02 mm.	0.007 mm.	0.002 mm.				
						Percent			
95	83	79	60	31	22	46	19	A-7-6(13)	ML-CL
93	85	78	63	37	28	43	21	A-7-6(13)	CL
86	58	57	43	24	16	23	9	A-4(5)	CL
95	85	79	63	28	17	29	6	A-4(8)	ML-CL
99	98	97	89	55	43	54	30	A-7-6(19)	CH
82	58	57	46	28	18	25	10	A-4(5)	CL
97	86	78	60	29	20	32	10	A-6(8)	ML-CL
86	65	64	55	38	30	37	17	A-6(9)	CL
76	49	46	35	21	15	22	9	A-4(3)	SC

analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

3/ SCS and BPR have agreed that all soils having plasticity indexes within two points of A-line are to be given a borderline classification. An example of a borderline classification obtained by this use is ML-CL.

Soil series and map symbols	Depth to seasonal water table	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Feet	Inches			
Blount: BmA, BmB2--------	1-3	0-7	Silt loam----------	ML or CL	A-4
		7-32	Silty clay loam to silty clay.	CL or CH	A-7
		32-60	Silty clay loam till--------	CL	A-6 or A-7
Brookston: Bs----------	0-3	0-14	Silty clay loam----------	ML or CL	A-7 or A-6
		14-31	Silty clay loam----------	CL or CH	A-7
		31-46	Clay loam----------	CL	A-6 or A-7
		46-66	Loam till----------	ML or CL	A-4 or A-6
Carlisle: Ca----------	0-3	0-60	Muck over peat----------	Pt	----------
Crosby: CsA, CsB2, CyB2-- (For properties of the Miami soil in CyB2, refer to the Miami series.)	1-3	0-10	Silt loam----------	ML or CL	A-4
		10-31	Silty clay loam----------	CL or CH	A-6 or A-7
		31-60	Clay loam to loam till------	ML, CL, or SM	A-4
Fincastle: Fc----------	1-3	0-10	Silt loam----------	ML	A-4
		10-28	Silty clay loam----------	CL	A-6
		28-54	Clay loam----------	CL	A-6
		54-60	Loam till----------	ML or CL	A-4
Fox: FoA, FoB2, FsC3-----	>4	0-12	Silt loam----------	ML	A-4
		12-37	Clay loam or gravelly clay loam.	CL or SC	A-6 or A-4
		37-70	Stratified gravel and sand--	GP, SP, or SP-SM	A-1
Genesee: Gh----------	3-7	0-30	Silt loam----------	ML or CL	A-4
		30-70	Fine sandy loam, silt loam, or fine sand.	SM	A-4 or A-2
Hennepin: HeE----------	>4	0-15	Loam----------	ML	A-4
		15-60	Loam till----------	ML	A-4
Kokomo: Kk, Ko----------	0-3	0-14	Silty clay loam----------	CL or CH	A-7
		14-59	Silty clay loam----------	CH	A-7
		59-64	Loam till----------	CL	A-4
Linwood: Lw----------	0-3	0-18	Muck----------	Pt	----------
		18-60	Silt loam----------	ML	A-4
Miami: MlB2, MlC2, MmB3, MmC3, MmD3.	>4	0-7	Silt loam----------	ML or ML-CL	A-4 or A-6
		7-32	Silty clay loam to clay loam.	CL	A-4, A-6, or A-7
		32-60	Loam till----------	ML, CL, or SC	A-4 or A-6

See footnotes at end of table.

Percentage passing sieve-- 1/			Permeability	Available water capacity	Reaction	Frost potential	Shrink-swell potential
No. 10	No. 40	No. 200					
			Inches per hour	Inches per inch of soil	pH		
100	90-100	85-95	0.63-2.00	0.20	6.1-6.5	Moderate-------	Low to moderate.
100	95-100	80-90	0.06-0.20	.17	5.6-6.0	Moderate-------	Moderate to high.
100	90-100	75-90	0.06-0.20	.18	(2/)	Moderate-------	Moderate.
95-100	90-100	80-90	0.20-0.63	.22	6.6-7.3	Moderate-------	Moderate.
95-100	90-100	80-90	0.06-0.20	.19	6.6-7.3	Moderate-------	Moderate.
95-100	90-100	80-90	0.06-0.20	.18	6.6-7.3	Moderate-------	Moderate.
90-95	80-90	55-65	0.63-2.00	.15	(2/)	Moderate-------	Low to moderate.
------	------	------	2.00-6.30	>.25	(3/)	Low------------	Low.
95-100	90-100	85-95	0.63-2.00	.20	6.1-6.6	Moderate to high.	Low to moderate.
95-100	95-100	90-100	0.06-0.20	.18	5.1-6.6	Moderate-------	Moderate.
80-90	70-85	45-60	0.63-2.00	.15	(2/)	Moderate-------	Low.
95-100	95-100	85-95	0.63-2.00	.20	5.1-6.5	Moderate to high.	Low.
95-100	90-95	85-95	0.06-0.20	.19	5.1-5.5	Moderate-------	Moderate.
95-100	75-85	65-75	0.06-0.20	.17	5.6-6.0	Moderate-------	Low to moderate.
95-100	75-85	60-70	0.63-2.00	.15	(2/)	Moderate to high.	Low.
95-100	85-100	50-75	0.63-2.00	.17	5.6-6.5	Moderate to high.	Low to moderate.
90-100	75-90	35-70	0.63-2.00	.16	5.1-6.0	Moderate-------	Moderate.
35-70	15-30	0-10	>20.00	.03	(2/)	Low------------	Low.
95-100	95-100	75-85	0.63-2.00	.20	6.6	Moderate to high.	Low.
80-90	60-70	25-45	2.00-6.30	.12	(2/)	Moderate to high.	Low.
95-100	80-100	60-70	0.63-2.00	.17	6.1-6.5	Moderate to high.	Low.
95-100	80-100	60-70	0.63-2.00	.15	(2/)	Moderate to high.	Low to moderate.
95-100	90-100	80-90	0.06-0.20	.22	6.6-7.3	Moderate-------	High.
95-100	95-100	75-90	0.06-0.20	.19	6.6-7.3	Moderate-------	High.
85-95	75-85	55-70	0.63-2.00	.15	(2/)	Moderate-------	Moderate.
------	------	------	2.00-6.30	>.25	5.6-6.5	Moderate-------	Low to moderate.
98	95	75	0.20-0.63	.20	(2/)	Moderate to high.	Low.
95-100	90-100	80-90	0.63-2.00	.20	6.1-6.5	Moderate to high.	Low.
90-100	85-95	60-70	0.63-2.00	.18	5.5-6.5	Moderate-------	Moderate.
85-95	70-80	45-65	0.63-2.00	.15	(2/)	Moderate-------	Low to moderate.

413-808 O - 71 - 4

TABLE 7.--ESTIMATED PROPERTIES

Soil series and map symbols	Depth to seasonal water table	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Feet	Inches			
Morley: MrB2, MsB3, MsC3-	>4	0-10	Silt loam	ML or CL	A-4
		10-33	Silty clay loam	CL or CH	A-7
		33-60	Silty clay loam till	CL	A-6
Ockley: OcA, OcB2, OkA, OkB2.	>4	0-8	Silt loam	ML	A-4
		8-29	Silty clay loam to clay loam.	CL	A-6
		29-54	Sandy clay loam to gravelly clay loam.	SC	A-2 or A-4
		54-70	Sand and gravel	SW, GP, or SP-SM	A-1
Patton: Pa, Pc	1-3	0-12	Silty clay loam	CL or OL	A-6
		12-37	Silty clay loam	CL	A-7
		37-52	Stratified sand and silt	ML	A-4
Pewamo: Pe	0-3	0-12	Silty clay loam	CL or OH	A-7
		12-49	Silty clay to silty clay loam.	CL or CH	A-7
		49-60	Silty clay loam till	CL	A-7
Russell: RuA, RuB2	>4	0-11	Silt loam	ML	A-4
		11-44	Silty clay loam to clay loam.	CL	A-6
		44-63	Loam	CL or ML	A-6
		63-74	Loam till	ML or CL	A-4 or A-6
Shoals: Sh	0-3	0-32	Silt loam	ML or OL	A-4
		32-60	Silt loam or stratified sand and sandy loam.	ML	A-4

1/ All soil material passed the No. 4 sieve except 30 to 50 percent of the underlying material of Ockley and Fox soils.

Percentage passing sieve-- 1/			Permeability	Available water capacity	Reaction	Frost potential	Shrink-swell potential
No. 10	No. 40	No. 200					
			Inches per hour	Inches per inch of soil	pH		
95-100	95-100	75-90	0.63-2.00	0.20	5.6-6.5	High----------	Low to moderate.
95-100	90-100	75-85	0.06-0.20	.18	5.6-6.0	High----------	Moderate to high.
95-100	85-95	75-85	0.06-0.20	.17	(2/)	High----------	Moderate.
95-100	90-100	85-95	0.63-2.00	.20	5.1-6.5	Moderate to high.	Low.
95-100	90-100	70-95	0.63-2.00	.19	5.5-6.0	Moderate------	Moderate.
95-100	80-90	30-40	0.63-2.00	.18	5.6-6.5	Moderate------	Moderate.
35-70	15-30	0-10	>20.0	.02	(2/)	Low----------	Low.
95-100	90-100	80-90	0.20-0.63	.20	6.1-7.3	Moderate------	Moderate.
95-100	90-100	80-90	0.20-0.63	.19	7.1-7.3	Moderate to high.	Moderate to high.
95-100	95-100	90-100	0.63-2.00	.18	(2/)	Moderate to high.	Low.
100	95-100	80-90	0.20-0.63	.19	6.6-7.3	Moderate------	Moderate.
95-100	95-100	80-85	<0.06	.16	6.6-7.3	High----------	High.
95-100	90-100	80-85	0.06-0.20	.19	(2/)	Moderate to high.	High.
100	95-100	85-90	0.63-2.00	.20	6.1-6.5	Moderate to high.	Low to moderate.
100	90-100	80-90	0.63-2.00	.18	5.0-6.0	Moderate------	Moderate.
95-100	75-85	70-80	0.63-2.00	.18	6.6-7.3	Moderate------	Low.
85-95	70-80	60-70	0.63-2.00	.15	(2/)	Moderate------	Low to moderate.
95-100	95-100	85-95	0.63-2.00	.21	6.6	High----------	Low.
95-100	90-100	75-85	0.63-2.00	.20	(2/)	Moderate to high.	Low.

2/ Calcareous.

3/ Variable.

Soil series and map symbols	Suitability as source of--			Soil features affecting--
	Topsoil	Sand and gravel	Road subgrade	Foundations for buildings
Blount: BmA, BmB2-	Good in surface layer; fair in subsoil; clayey; seasonal high water table.	Not suitable----------	Poor in subsoil; moderate to high shrink-swell; difficult to compact when wet; fair to poor in substratum; moderate shrink-swell; seasonal high water table.	Seasonal high water table; fair shear strength and compressibility; fair to poor bearing capacity.
Brookston: Bs-----	Fair in surface layer; fair to poor in subsoil; clayey; seasonal high water table.	Not suitable----------	Fair to poor; low to moderate shrink-swell; fair to poor bearing capacity; subject to frost heave; seasonal high water table.	Seasonal high water table; fair to poor bearing capacity; low to moderate shrink-swell; medium compressibility; subject to liquefaction.
Carlisle: Ca------	Poor; erosive; oxidizes rapidly; fair to poor when mixed with mineral soil.	Not suitable----------	Very poor; unstable; seasonal high water table; should be avoided wherever possible.	Unstable; very high compressibility; seasonal high water table.
Crosby: CsA, CsB2, CyB2. (For properties of Miami soil in CyB2, refer to the Miami series.)	Good in surface layer; fair to poor in subsoil; seasonal high water table.	Not suitable----------	Poor; moderate to low shrink-swell; difficult to compact when wet.	Fair shear strength and compressibility; moderate to low shrink-swell; subject to frost heave; seasonal high water table.
Fincastle: Fc-----	Good in surface layer; fair to poor in subsoil; seasonal high water table.	Not suitable----------	Poor; moderate to low shrink-swell; difficult to compact when wet.	Fair shear strength and compressibility; moderate to low shrink-swell; subject to frost heave; seasonal high water table.
Fox: FoA, FoB2, FsC3.	Good in surface layer; poor to fair in subsoil; somewhat gravelly and clayey.	Very good below 3 feet.	Fair to good in subsoil; very good below 3 feet.	Features favorable in upper 3 feet; very favorable below a depth of 3 feet.

Soil features affecting--Continued				Degree and kind of limitation for--	
Highway location	Farm ponds		Agricultural drainage	Septic tank filter fields	Sewage lagoons
	Reservoir area	Embankment			
Seasonal high water table; fair to poor bearing capacity; subject to frost heave.	Seasonal high water table; features normally favorable for dug ponds.	Suitable material; moderate to high shrink-swell; high clay content.	Seasonal high water table; slow permeability; surface drainage needed.	Severe: seasonal high water table; slow permeability.	Slight: slow permeability; nearly level slopes.
Seasonal high water table; fair to poor bearing capacity; subject to frost heave.	Seasonal high water table; features normally favorable for dug ponds.	Suitable material; low to moderate shrink-swell; high clay content.	Seasonal high water table; slow permeability; depressional; surface and subsurface drainage needed.	Severe: seasonal high water table and ponding; slow permeability.	Moderate: high organic-matter content.
Unstable; depressional; seasonal high water table.	Seasonal high water table; features normally favorable for dug ponds.	Material not suitable; high organic-matter content.	High organic-matter content; subsidence; seasonal high water table; surface and subsurface drainage needed.	Severe: seasonal high water table; depressional.	Severe: high organic-matter content; seasonal high water table.
Seasonal high water table; fair bearing capacity and stability; subject to frost heave.	Seasonal high water table; features normally favorable for dug ponds.	Suitable material; low to moderate shrink-swell; high clay content.	Seasonal high water table; slow permeability; surface and subsurface drainage needed.	Severe: seasonal high water table; slow permeability.	Slight: slow permeability; nearly level slopes.
Seasonal high water table; fair bearing capacity and stability; subject to frost heave.	Seasonal high water table; features normally favorable for dug ponds.	Suitable material; low to moderate shrink-swell; high clay content.	Seasonal high water table; slow permeability; surface and subsurface drainage needed.	Severe: seasonal high water table; slow permeability.	Slight: slow permeability; nearly level slopes.
Features are favorable; well drained, loose sand is easy to excavate but is sometimes difficult to haul.	Very rapidly permeable substratum.	Material not suitable except for pervious shells.	Good drainage---	Slight: no restrictions; effluent may pollute water supplies; soils on slopes of more than 10 percent are generally unsuitable.	Severe: moderate permeability; very rapid permeability in substratum.

TABLE 8.--ENGINEERING INTERPRETATIONS

Soil series and map symbols	Suitability as source of--			Soil features affecting--
	Topsoil	Sand and gravel	Road subgrade	Foundations for buildings
Genesee: Gh-------	Fair to good; subject to flooding.	Poor; some below 4 feet.	Poor bearing capacity; difficult to work when wet; subject to flooding.	Subject to flooding; poor bearing capacity; subject to frost heave.
Hennepin: HeE-----	Fair to good in surface layer; fair to poor in subsoil.	Not suitable----------	Fair to poor; moderate to low shrink-swell; fair to poor bearing capacity; difficult to work and to compact when wet.	Fair to poor bearing capacity; moderate to low shrink-swell; fair shear strength; subject to frost heave.
Kokomo: Kk, Ko----	Poor; clayey; seasonal high water table.	Not suitable----------	Poor; moderate to high shrink-swell; fair to good bearing capacity; difficult to compact; subject to frost heave; seasonal high water table.	Seasonal high water table; fair to poor bearing capacity; moderate to high shrink-swell; medium compressibility; subject to liquefaction.
Linwood: Lw-------	Poor; erosive; oxidizes rapidly.	Not suitable----------	Very poor; unstable; seasonal high water table; should be avoided whenever possible.	Unstable; very high compressibility; seasonal high water table.
Miami: MlB2, MlC2, MmB3, MmC3, MmD3.	Good in surface layer; fair in subsoil; somewhat clayey.	Not suitable----------	Fair to poor; moderate to low shrink-swell; fair to poor bearing capacity; difficult to work and to compact when wet.	Fair to poor bearing capacity; moderate to low shrink-swell; fair shear strength; subject to frost heave.
Morley: MrB2, MsB3, MsC3.	Fair in surface layer; fair to poor in subsoil; clayey.	Not suitable----------	Poor to not suitable in subsoil; moderate to high shrink-swell; difficult to work when wet; poor to fair in substratum; moderate to high shrink-swell; difficult to work and to compact when wet.	Fair to poor bearing capacity; moderate to high shrink-swell; fair shear strength; medium compressibility.

OF THE SOILS--Continued

Soil features affecting--Continued				Degree and kind of limitation for--	
Highway location	Farm ponds		Agricultural drainage	Septic tank filter fields	Sewage lagoons
	Reservoir area	Embankment			
Subject to flooding; poor bearing capacity.	Subject to flooding.	Suitable material to a depth of 4 feet.	Subject to flooding; protection from stream overflow is required.	Severe: subject to flooding.	Severe: subject to flooding; moderate permeability.
Fair to poor bearing capacity; cuts and fills are needed.	Suitable material; steep slopes.	Suitable material; steep slopes.	Good drainage---	Severe: steep slopes.	Severe: steep slopes.
Seasonal high water table; fair to poor bearing capacity; poor shear strength; subject to frost heave; unstable material.	Seasonal high water table; features normally favorable for dug ponds.	Suitable material; moderate to high shrink-swell; high clay content.	Seasonal high water table; slow permeability; depressional; surface and subsurface drainage needed.	Severe: seasonal high water table and ponding; slow permeability.	Moderate: high organic-matter content.
Unstable; depressional; seasonal high water table.	Seasonal high water table; features normally favorable for dug ponds.	Material not suitable; high organic-matter content.	High organic-matter content; subsidence; seasonal high water table; surface and subsurface drainage needed.	Severe: seasonal high water table; depressional.	Severe: organic-matter content; seasonal high water table and ponding.
Fair to poor bearing capacity; subject to frost heave; cuts and fills are needed.	Suitable material; sand and gravel pockets or layers occur in the substratum.	Suitable material.	Good drainage--	Moderate to severe: 0 to 12 percent slopes; moderate permeability.	Moderate on slopes of less than 7 percent; severe on slopes of more than 7 percent; moderate permeability.
Fair to poor bearing capacity; subject to frost heave; cuts and fills are needed.	Features generally favorable.	Suitable material; moderate to high shrink-swell.	Good drainage; small wet areas may need random tile.	Severe: slow permeability; large filter beds necessary.	Moderate on slopes of less than 7 percent; severe on slopes of more than 7 percent; slow permeability.

TABLE 8.--ENGINEERING INTERPRETATIONS

Soil series and map symbols	Suitability as source of--			Soil features affecting--
	Topsoil	Sand and gravel	Road subgrade	Foundations for buildings
Ockley: OcA, OcB2, OkA, OkB2.	Good in surface layer; fair in subsoil; somewhat clayey and contains gravel.	Very good below 4 feet.	Fair to poor in subsoil; very good in substratum.	Features in subsoil are fair to good; substratum has very good bearing capacity.
Patton: Pa, Pc----	Fair in surface layer; fair to poor in subsoil; clayey; seasonal high water table.	Poor; variable sand layers below 4 feet.	Fair to poor; moderate to high shrink-swell; poor bearing capacity.	Seasonal high water table; fair to poor bearing capacity; moderate to high shrink-swell.
Pewamo: Pe--------	Fair in surface layer; fair to poor in subsoil; clayey; seasonal high water table.	Not suitable----------	Poor; difficult to compact; high shrink-swell; fair to poor bearing capacity; subject to frost heave; seasonal high water table.	Seasonal high water table; fair to poor bearing capacity; high shrink-swell; medium compressibility; fair shear strength; subject to liquefaction.
Russell: RuA, RuB2.	Good in surface layer; fair in subsoil; somewhat clayey.	Not suitable----------	Fair to poor; low to moderate shrink-swell; fair to poor bearing capacity; difficult to work and to compact when wet.	Moderate to low shrink-swell; fair to poor bearing capacity; fair shear strength.
Shoals: Sh-------	Fair to good; subject to flooding; seasonal high water table.	Poor; some below 4 feet; seasonal high water table hinders excavation.	Poor; poor bearing capacity; difficult to work and to compact when wet; seasonal high water table.	Subject to flooding; seasonal high water table; subject to frost heave.

Soil features affecting--Continued				Degree and kind of limitation for--	
Highway location	Farm ponds		Agricultural drainage	Septic tank filter fields	Sewage lagoons
	Reservoir area	Embankment			
Features are favorable; good bearing capacity; well-drained, loose sand and gravel is easy to excavate but is sometimes difficult to haul.	Very rapidly permeable substratum; features generally unfavorable.	Material not suitable except for pervious shells.	Good drainage---	Slight: effluent may pollute water supplies; slopes of more than 10 percent are generally unsuitable.	Severe: very rapid permeability in substratum.
Seasonal high water table; fair to poor bearing capacity; fair shear strength; subject to frost heave.	Seasonal high water table; features normally favorable for dug ponds.	Suitable material; moderate to low shrink-swell; high clay content.	Seasonal high water table; moderately slow permeability; surface and subsurface drainage needed; depressional; silt and sand may be hazard below a depth of 40 inches.	Severe: seasonal high water table and ponding; moderately slow permeability.	Moderate: high organic-matter content.
Seasonal high water table; fair to poor bearing capacity; subject to frost heave; poor shear strength; unstable material.	Seasonal high water table; features normally favorable for dug ponds.	Suitable material; high shrink-swell; high clay content.	Seasonal high water table; very slow permeability; surface and subsurface drainage needed; depressional.	Severe: seasonal high water table and ponding; very slow permeability.	Moderate: high organic-matter content; seasonal high water table.
Fair to poor bearing capacity; subject to frost heave; cuts and fills are needed.	Suitable material; sand and gravel pockets or layers occur in the substratum.	Suitable material.	Good drainage----	Moderate: moderate permeability.	Moderate: moderate permeability.
Subject to flooding; seasonal high water table; subject to frost heave.	Subject to flooding.	Suitable material to a depth of 3 feet.	Seasonal high water table; protection from flooding required; random tile suitable for subsurface drainage.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding; seasonal high water table; moderate permeability.

Soil series and map symbols	Intensive play areas	Picnic areas, parks, and extensive play areas	Bridle paths, nature trails, and hiking trails
Blount: BmA, BmB2--	Moderate: seasonal high water table; compact and sticky when wet; slow to dry after rain.	Moderate: seasonal high water table; compact and sticky when wet; slow to dry after rain.	Moderate: wet for short periods; muddy and slippery when wet; may need surfacing.
Brookston: Bs------	Severe: seasonal high water table; occasional ponding; needs drainage; poor trafficability; sod easily damaged when wet; very sticky when wet.	Severe: seasonal high water table; occasional ponding; needs drainage; poor trafficability; sod easily damaged when wet; very sticky when wet.	Severe: wet for long periods; muddy and slippery when wet; needs surfacing and is difficult to maintain.
Carlisle: Ca-------	Very severe: seasonal high water table; needs drainage; poor trafficability when wet; sod easily damaged; subject to soil blowing when dry.	Very severe: seasonal high water table; needs drainage; poor trafficability when wet; sod easily damaged; subject to soil blowing when dry.	Very severe: seasonal high water table; poor trafficability; difficult to maintain.
Crosby: CsA, CsB2, CyB2: (For properties of Miami soils in CyB2, refer to the Miami series.)	Moderate: seasonal high water table; compact and sticky when wet; slow to dry after rain.	Moderate: seasonal high water table; compact and sticky when wet; slow to dry after rain.	Moderate: wet for short periods; muddy and slippery when wet; may need surfacing.
Fincastle: Fc------	Moderate: seasonal high water table; compact and sticky when wet; slow to dry after rain.	Moderate: seasonal high water table; compact and sticky when wet; slow to dry after rain.	Moderate: wet for short periods; muddy and slippery when wet; may need surfacing.
Fox: FoA, FoB2, FsC3.	Slight on 0 to 2 percent slopes; moderate on 2 to 6 percent slopes; severe on 6 to 12 percent slopes; erosive; compact and sticky when wet; extensive leveling may expose the sand and gravel substratum.	Slight on 0 to 6 percent slopes; moderate on 6 to 12 percent slopes; erosive; compact and sticky when wet; extensive leveling may expose the sand and gravel substratum.	Moderate: 0 to 12 percent slopes; muddy and slippery when wet; erosive; may need surfacing; extensive leveling may expose the sand and gravel substratum.
Genesee: Gh--------	Severe: occasional flooding; compacts easily when wet.	Moderate: occasional flooding during season of use.	Moderate: occasional flooding; muddy and slippery when wet; may need surfacing.
Hennepin: HeE------	Severe: erosive on slopes; compact and sticky when wet.	Severe: erosive; compact and sticky when wet.	Severe: muddy and slippery when wet; erosive; may need surfacing.
Kokomo: Kk, Ko-----	Severe: seasonal high water table; occasional ponding; needs drainage; poor trafficability; sod easily damaged when wet; very sticky when wet.	Severe: seasonal high water table; occasional ponding; needs drainage; poor trafficability; sod easily damaged when wet; very sticky when wet.	Severe: wet for long periods; muddy and slippery when wet; needs surfacing and is difficult to maintain.

Golf fairways	Cottages and service and utility buildings	Tent, camp, and trailer sites
Moderate: seasonal high water table; compacts easily when wet; turf easily damaged.	Moderate to severe: seasonal high water table restricts sanitary systems.	Moderate: sites remain wet and soft for short periods; compacts easily; walks and roads need surfacing.
Severe: seasonal high water table; occasional ponding; needs drainage; poor trafficability; turf easily damaged when wet.	Severe: seasonal high water table and occasional ponding restricts sanitary systems; needs drainage; subject to frost heave.	Severe: seasonal high water table; occasional ponding; needs drainage; sites remain wet for long periods; walks and roads need surfacing; very sticky when wet.
Very severe: seasonal high water table; needs drainage; poor trafficability; turf easily damaged.	Very severe: seasonal high water table restricts sanitary systems; low shrink-swell; low bearing capacity; subject to soil blowing when dry.	Very severe: sites remain wet for long periods; poor trafficability; difficult to maintain walks and roadways; subject to soil blowing when dry.
Moderate: seasonal high water table; compacts easily when wet; turf easily damaged.	Moderate to severe: seasonal high water table restricts sanitary systems.	Moderate: sites remain wet and soft for short periods; compacts easily; walks and roads need surfacing.
Moderate: seasonal high water table; compacts easily when wet; turf easily damaged.	Moderate to severe: seasonal high water table restricts sanitary systems.	Moderate: sites remain wet and soft for short periods; compacts easily; walks and roads need surfacing.
Slight on 0 to 6 percent slopes; moderate on 6 to 12 percent slopes; erosive; extensive leveling may expose the sand and gravel substratum.	Slight on 0 to 6 percent slopes; moderate on 6 to 12 percent slopes; erosive; extensive leveling may expose the sand and gravel substratum.	Slight on 0 to 6 percent slopes; moderate on 6 to 12 percent slopes; wet and soft after rain; walks and roads need surfacing; compacts easily; extensive leveling may expose the sand and gravel substratum.
Moderate: occasional flooding; turf easily damaged when wet.	Severe: occasional flooding; fluctuating water table restricts sanitary systems; subject to frost heave; liquefies easily.	Severe: occasional flooding; wet for short periods; sites need protection.
Severe: erosive----------	Severe: erosive----------	Severe: wet and soft after rain; walks and roads need surfacing; compacts easily when wet.
Severe: seasonal high water table; occasional ponding; needs drainage; poor trafficability; turf easily damaged when wet.	Severe: high water table; restricts sanitary systems; occasional ponding; needs drainage; subject to frost heave.	Severe: seasonal high water table; occasional ponding; needs drainage; sites remain wet for long periods; walks and roads need surfacing; very sticky when wet.

Soil series and map symbols	Intensive play areas	Picnic areas, parks, and extensive play areas	Bridle paths, nature trails, and hiking trails
Linwood: Lw--------	Very severe: seasonal high water table; needs drainage; poor trafficability when wet; sod easily damaged; subject to soil blowing when dry.	Very severe: seasonal high water table; needs drainage; poor trafficability when wet; sod easily damaged; subject to soil blowing when dry.	Very severe: seasonal high water table; poor trafficability; difficult to maintain.
Miami: MlB2, MlC2, MmB3, MmC3, MmD3.	Moderate on 2 to 6 percent slopes; severe on 6 to 12 percent slopes; erosive; compact and sticky when wet.	Slight on 2 to 6 percent slopes; moderate on 6 to 12 percent slopes; severe on 12 to 18 percent slopes; erosive; compact and sticky when wet.	Moderate on 2 to 12 percent slopes; severe on 12 to 18 percent slopes; muddy and slippery when wet; erosive; may need surfacing.
Morley: MrB2, MsB3, MsC3.	Moderate on 2 to 6 percent slopes; severe on 6 to 12 percent slopes; erosive; compacts easily when wet.	Slight on 2 to 6 percent slopes; moderate on 6 to 12 percent slopes; erosive; compacts easily when wet.	Moderate: muddy and slippery when wet; may need surfacing.
Ockley: OcA, OcB2, OkA, OkB2.	Slight on 0 to 2 percent slopes; moderate on 2 to 6 percent slopes; erosive; compact and sticky when wet.	Slight: erosive; compact and sticky when wet.	Moderate: muddy and slippery when wet; may need surfacing; erosive.
Patton: Pa---------	Severe: seasonal high water table; occasional ponding; needs drainage; poor trafficability; sod easily damaged when wet; very sticky when wet.	Severe: seasonal high water table; occasional ponding; needs drainage; poor trafficability; sod easily damaged when wet; very sticky when wet.	Severe: wet for long periods; muddy and slippery when wet; needs surfacing and is difficult to maintain.
Patton: Pc---------	Very severe: frequent flooding; seasonal high water table; subject to ponding.	Very severe: frequent flooding; seasonal high water table; subject to ponding; wet for long periods.	Severe: frequent flooding; seasonal high water table; subject to ponding; muddy and slippery when wet; may need surfacing.
Pewamo: Pe---------	Severe: seasonal high water table; occasional ponding; needs drainage; poor trafficability; sod easily damaged when wet; very sticky when wet.	Severe: seasonal high water table; occasional ponding; needs drainage; poor trafficability; sod easily damaged when wet; very sticky when wet.	Severe: wet for long periods; muddy and slippery when wet; needs surfacing and is difficult to maintain.
Russell: RuA, RuB2-	Slight on 0 to 2 percent slopes; moderate on 2 to 6 percent slopes; erosive; compact and sticky when wet.	Slight: erosive; compact and sticky when wet.	Moderate: muddy and slippery when wet; erosive; may need surfacing.
Shoals: Sh---------	Severe: frequent flooding; seasonal high water table; compacts easily when wet; slow to dry after rain; needs drainage and runoff control.	Severe: frequent flooding during season of use; seasonal high water table.	Moderate: frequent flooding; slow to dry after rain; seasonal high water table; muddy and slippery when wet; may need surfacing.

FOR RECREATIONAL USES--Continued

Golf fairways	Cottages and service and utility buildings	Tent, camp, and trailer sites
Very severe: seasonal high water table; needs drainage; poor trafficability; turf easily damaged.	Very severe: seasonal high water table restricts sanitary systems; low shrink-swell; low bearing capacity; subject to soil blowing when dry.	Very severe: sites remain wet for long periods; poor trafficability; difficult to maintain walks and roadways; subject to soil blowing when dry.
Slight on 2 to 6 percent slopes; moderate on 6 to 12 percent slopes; severe on 12 to 18 percent slopes; erosive.	Slight on 2 to 6 percent slopes; moderate on 6 to 12 percent slopes; severe on 12 to 18 percent slopes; erosive.	Slight on 2 to 6 percent slopes; moderate on 6 to 12 percent slopes; severe on 12 to 18 percent slopes; wet and soft after rain; walks and roads need surfacing; compacts easily when wet.
Moderate: 2 to 12 percent slopes; erosive; turf easily damaged when wet.	Moderate: low bearing capacity; moderate to high shrink-swell.	Slight on 2 to 6 percent slopes; moderate on 6 to 12 percent slopes; sites remain wet for short periods; walks and roads need surfacing.
Slight: erosive----------	Slight: erosive----------	Slight: wet and soft after rain; walks and roads need surfacing; compacts easily when wet.
Severe: seasonal high water table; occasional ponding; needs drainage; poor trafficability; turf easily damaged when wet.	Severe: seasonal high water table restricts sanitary systems; occasional ponding; needs drainage; subject to frost heave.	Severe: seasonal high water table; occasional ponding; needs drainage; sites remain wet for long periods; walks and roads need surfacing; very sticky when wet.
Very severe: frequent flooding; seasonal high water table; subject to ponding; difficult to maintain turf; poor trafficability.	Very severe: seasonal high water table restricts sanitary systems; frequent flooding; subject to ponding; subject to frost heave.	Very severe: seasonal high water table; frequent flooding; subject to ponding; sites need protection; remains wet for long periods; walks and roads need surfacing.
Severe: seasonal high water table; occasional ponding; needs drainage; poor trafficability; turf easily damaged when wet.	Severe: seasonal high water table restricts sanitary systems; occasional ponding; needs drainage; subject to frost heave; high shrink-swell.	Severe: seasonal high water table; occasional ponding; needs drainage; sites remain wet for long periods; walks and roads need surfacing; very sticky when wet.
Slight: erosive----------	Slight: erosive----------	Slight: 0 to 6 percent slopes; wet and soft after rain; walks and roads need surfacing; compacts easily when wet.
Moderate: frequent flooding; seasonal high water table; turf easily damaged when wet.	Severe: frequent flooding and seasonal high water table restrict sanitary systems; subject to frost heave.	Severe: frequent flooding and seasonal high water table; sites need protection; difficult to maintain walks and roads.

In this section, the factors that affect the formation of soils are discussed and the soil series of the county are placed in the higher categories of soil classification.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on geologic materials. The characteristics of any given soil are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate in which the soil has formed; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time these factors have acted on the soil material.

Parent Material

Parent material is the unconsolidated mass from which soil is formed. The soils in Howard County formed mainly from Wisconsin glacial till (pl. IV), glacial outwash (pl. IV), and recently deposited alluvium.

In the area of Howard County, the preglacial landscape consisted mostly of limestone bedrock of two different periods. The youngest and most extensive is Silurian limestone that contains a small amount of shale. Less extensive is the older Devonian limestone that occurs mostly along the northern edge of Clay and Ervin townships, in Center township, and in the southwestern part of Honey Creek township.

This limestone bedrock is generally covered by many feet of glacial material and does not influence the characteristics of the soil profile. However, the limestone is a locally important natural resource and is used extensively for liming cropland and as base material for roads, driveways, parking lots, and houses. It is also used in concrete and asphalt.

Glaciers covered the area of Howard County several times and in most places deposited as much as 50 to 100 feet of till over the bedrock. The till deposited by the Wisconsin Glacier is most recent and directly affects the characteristics of the soils.

The northeastern part of the county was covered by a lobe of the Wisconsin Glacier that scraped across shale and limestone. The till in this area contains more clay-forming minerals than the till elsewhere. Consequently, the Morley, Blount, and Pewamo soils in this area contain more clay in their profiles than other soils in the county.

The rest of Howard County was covered by a lobe of dominantly loam-textured glacial till of more mixed origin. This is the parent material of Miami, Crosby, Russell, Fincastle, and Brookston soils.

The two lobes were separated by the Union City moraine. This moraine is at about the same elevation as the till plains. It extends in a southeasterly direction from the north county line near Cassville to just west of Greentown, and then to the Grant County line about 2 miles east of West Liberty.

The valleys of Wildcat Creek and other smaller creeks in the county were formed from melt waters of the receding glacier. After the ice melted, the size of the streams was greatly reduced, and gravel and sand were deposited in narrow areas along the valleys. Fox and Ockley soils formed in layers of gravel and sand. These soils are distinctly different from those that formed in glacial till.

Soils on the bottom land along Wildcat Creek and its tributaries formed in recently deposited alluvium. Soil material eroded from upland terraces is still being deposited in thin layers on the flood plains. Unlike soils on upland till plains and outwash terraces, the Genesee and Shoals soils on flood plains do not have distinct horizons because the creeks overflow and new soil material is deposited frequently.

Silt deposited by wind has covered all parts of the county and has modified the soils on uplands and terraces. The Russell, Fincastle, and Ockley soils in the western part of the county are covered by as much as 3 feet of silt. Except for this silt mantle, these soils closely resemble Miami, Crosby, and Fox soils, respectively. The silt mantle elsewhere in the county ranges from about 8 to 18 inches in thickness.

Climate

Climate affects the type of vegetation that grows on a soil, the rate of weathering of soil materials, and the formation of horizons within the soil. Water from heavy rainfall leaches plant nutrients from the surface and subsoil layers and prevents free calcium carbonates from accumulating in the solum. Organic matter and very fine silt and clay particles are translocated by water that percolates through the soil. Freezing temperatures help break down soil materials, and warm temperatures accelerate chemical reactions within the soil.

The climate of Howard County is continental. The average annual precipitation is 37 inches. It is rather uniformly distributed throughout the year, but is slightly greater in spring and summer than in fall and winter. Because the climate is uniform throughout the county, it does not account for major differences between the soils. More information about the climate of Howard County can be obtained in the "Climate" section of this survey.

Plants and Animals

Plants, animals, insects, bacteria, and fungi are important in the formation of soils because they provide organic matter, nitrogen, and plant nutrients and change the structure and improve the porosity of the soils.

The effect of vegetation on soil is the most easily recognized. The native vegetation of Howard County is mostly hardwood trees. Trees bring plant nutrients from deep strata in the soil and deposit leaves, twigs, and branches on the surface. In wooded soils on uplands, this organic matter is mixed into the uppermost 1 or 2 inches. The native vegetation on soils of the Brookston, Kokomo, Patton, and Pewamo series was water-tolerant trees, shrubs, and grasses. In the Carlisle and Linwood series are organic soils that formed in ponded areas from relatively undecomposed deposits of water-tolerant reeds, sedges, grasses, and trees. These soils were covered with water much of the time. Organic matter that fell into the water decayed slowly and accumulated gradually.

Animals also are important in the formation of soils. Crayfish, snakes, earthworms, insects, and many small mammals burrow into soils and affect their characteristics. For example, earthworms, crayfish, ants and other insects inhabit Brookston, Kokomo, Patton, and Pewamo soils and help keep these upland soils friable. Bacteria, fungi, and microorganisms help to weather rocks and to decompose organic matter. They influence the chemical, physical, and biological processes that affect the formation of soil.

Man has also greatly affected soils by soil management practices, such as draining, fertilizing, and plowing.

Relief

Relief, or the lay of the land, determines the pattern of natural drainage. Most soils in Howard County are nearly level. Gently sloping to very steep soils occur between the bottom lands and till plains. The profile of moderately steep soils is generally less strongly developed than that of nearly level to sloping soils. This difference is caused by rapid erosion on steeper soils, reduced percolation of water through the soil material, and lack of water in the soil for the vigorous growth of plants.

Soils that occupy different positions in the landscape may have different characteristics even though they developed from the same kind of parent material. A good example of this is Brookston and Hennepin soils, each of which formed in medium-textured glacial till that has a thin loess mantle. Brookston soils are nearly level, very poorly drained, dark colored, and mottled, and they have slow permeability. Hennepin soils are very steep, well drained, dark colored, and free of mottles, and they have moderate permeability.

Time

Time is required for the formation of distinct horizons in soils. The profiles of young soils show very little development, and those of older soils have well expressed horizons. The oldest soils in Howard County developed in material weathered from glacial till or glacial outwash. Miami, Russell, Morley, and Ockley soils are examples of old soils that have well-developed horizons. Hennepin soils are young. They are shallow over glacial till and developed on steep and very steep slopes where soil material erodes nearly as rapidly as it forms. Genesee and Shoals soils on bottom lands also are young soils. Alluvium is deposited on them periodically, and their horizons are not well defined.

Classification of the Soils

Soils are classified so that we may more easily remember their significant characteristics; assemble knowledge about them; see their relationships to one another and to the whole environment; and develop principles that help us understand their behavior and response to manipulation (2, 4, 5). First, through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of lands.

The current system of soil classification (7) defines classes in terms of observable or measureable properties of soils. The properties chosen are primarily those that permit grouping soils that are similar in genesis. Genesis, or mode of soil origin, does not appear in the definition of the classes; it lies behind the classes. The classification is designed to accomodate all soils.

The classification has six categories. Beginning with the most inclusive, the categories are the order, suborder, great group, subgroup, family, and series. In table 10 the series of Howard County are placed in families, subgroups, and orders. Gravel pits, Made land, and Quarries are not included in the table. Each of the six categories in the system is described briefly in the following paragraphs.

ORDER: Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates.

The soil orders represented in Howard County are Alfisols, Histosols, Inceptisols, and Mollisols.

Alfisols are soils that have clay-enriched B horizons that are high in base saturation. Histosols developed under water-tolerant trees, shrubs, and grasses, and have thick layers of organic matter in various stages of decomposition. Inceptisols are young soils that occur mostly on land surfaces that formed fairly recently. Mollisols commonly developed under grass vegetation. In Howard County the Mollisols developed under water-tolerant hardwood trees and grasses. They have a thick, dark-colored surface layer.

SUBORDER: Each order is divided into suborders, primarily on the basis of those soil

characteristics that seem to produce classes having the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders mainly reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation. The suborders are not given in table 10.

GREAT GROUP: Each suborder is divided into great groups on the basis of uniformity in the kinds, sequence, and features of major soil horizons. The horizons used to make separations are those in which clay, iron, or humus has accumulated or those that have pans that interfere with growth of roots or movement of water. The features considered are the self-mulching properties of clays, soil temperature, and major differences in chemical composition, mainly the content of calcium, magnesium, sodium, and potassium. The great group is not shown separately in table 10 because it is the last word in the name of the subgroup.

SUBGROUP: Each great group is divided into subgroups. One subgroup represents the central (typic) segment of the group. Others, called intergrades, have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made if the properties of a soil in one group are within the ranges defined for another great group, suborder, or order.

FAMILY: Families are established within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

SERIES: As explained in the section "How This Survey Was Made," the series is a group of soils that, except for texture of the surface layer, have major horizons similar in important characteristics and in arrangement in the profile. They are given the name of a geographic location near the place where that series was first observed and mapped. An example is the Miami soil.

TABLE 10.--CLASSIFICATION OF THE SOILS[1/]

Series	Family	Subgroup	Order
Blount	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Brookston	Fine-loamy, mixed, noncalcareous, mesic	Typic Argiaquolls	Mollisols.
Carlisle	---	---	Histosols.
Crosby	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Fincastle	Fine-silty, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Fox	Fine-loamy over sandy or sandy skeletal, mixed, mesic.	Typic Hapludalfs	Alfisols.
Genesee	Fine-loamy, mixed, mesic	Fluventic Eutrochrepts	Inceptisols.
Hennepin	Fine-loamy, mixed, mesic	Typic Eutrochrepts	Inceptisols.
Kokomo	Fine, mixed, noncalcareous, mesic	Typic Argiaquolls	Mollisols.
Linwood	---	---	Histosols.
Miami	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Morley	Fine, illitic, mesic	Typic Hapludalfs	Alfisols.
Ockley	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Patton	Fine-silty, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
Pewamo	Fine, mixed, noncalcareous, mesic	Typic Argiaquolls	Mollisols.
Russell	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Shoals	Fine-loamy, mixed, nonacid, mesic	Aeric Fluventic Haplaquepts.	Inceptisols.

[1/] Placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

This section provides information that will interest people who are not familiar with the county. The physiography, climate, settlement, agriculture, and industry of the county are briefly discussed.

Physiography and Relief

All of Howard County is within the Tipton Till Plain, which forms part of the Central Lowland Province of the United States. The county has three physiographic subdivisions: the upland till plain; the outwash terraces; and the bottom lands.

Most extensive is the upland till plain. It is nearly level, except along major stream valleys, where it is gently sloping to very steep. Except for a few eroded areas, the nearly level areas of the till plain are much the same as they were after the last glacier receded. The average elevation of the till plain is 820 feet above sea level. Elevation is as low as 705 feet where Wildcat Creek leaves the county and as high as 870 feet two miles east of Greentown.

Outwash terraces and bottom lands are of minor extent. They occur mainly along Wildcat Creek and in small areas along Kokomo, Little Wildcat, and Honey Creeks. Almost all of the gravel pits and limestone quarries presently in use are in these areas.

The county is within the Wabash River drainage basin. About 60 percent of the county is drained by Wildcat Creek, which flows through the center of the county in a westerly direction. About 30 percent of the county is drained by Deer Creek and its tributaries to the northwest, and the rest is drained by Sugar and Pipe Creeks to the north.

Drainageways in the nearly level till plain are weak or undeveloped. Natural drainage is poor, and swamps or marshes were common before artificial drainage systems were installed. Initially open ditches were dug to drain the wet areas, and later underground tile drains were installed. Open ditches and tile drains are required on most farms.

Climate[4/]

Howard County has a continental climate. The topography is relatively level and climate is uniform throughout the county. Low-pressure and high-pressure fronts pass through the county each week. A high-pressure front generally brings lower temperatures and humidity and sunny weather. A low-pressure front brings higher temperatures and humidity, southerly winds, and rainy weather. Weather varies most in spring and least late in summer and early in fall. Table 11 gives the average precipitation in the county for the period 1934-1963, and table 12 gives the probable dates of the last freezing temperature in spring and the first in fall.

Precipitation is rather evenly distributed throughout the year, and it is usually adequate in all seasons for many types of crops. About one-third of the total annual precipitation enters streams and flows out of the county. Generally precipitation is greater in spring and early in summer than in winter. Spring rains are very reliable. They insure that soil moisture is near the maximum as summer approaches and as losses from evaporation begin to exceed rainfall. Late in summer, drought is a hazard, but drought is never severe.

Snowfall varies from year to year. Heavy snowstorms may occur, but the snow blanket protects winter grains from the very cold temperatures that generally accompany these storms. The record snowfall was 19 inches in January 1943, but in average years only about 5 inches of snow falls in January and February and 3 inches in March. Little or no snow falls from the beginning of May to the end of October.

Temperatures are relatively mild throughout the year. The temperature may rise above 90° F. for a few days each summer, and fall below zero a few days in winter. Temperatures in spring and fall are mild, but spring has more rain and thunderstorms. In fall, air and soil temperatures are nearly the same and convective activity is slight.

The column "Heating degree days" in table 11 compares the monthly heating requirements in the county. The degree days for each month are obtained by substracting the average temperature for each day in the month from 65° F., and then adding the results for all the days in the month.

Table 12 gives the probable dates for the last freeze in spring and the first freeze in fall (3). The average date for both seasons is given in the 50-percent column. Probabilities also are given for temperatures above and below freezing. The table shows that 1 year in 4 the last freeze in spring probably will occur after May 1, and the first freeze in fall probably will occur before October 14.

Relative humidity is not regularly measured in the county, but estimates can be made. The highest humidity usually occurs at the daily minimum temperature, and the lowest humidity occurs at the daily maximum temperature. On sunny days in summer, humidity is as low as 45 percent early in the afternoon when the temperature is highest, and it is more than 90 percent at sunrise when temperature is lowest.

Prevailing winds blow from the southwest, but for about 1 or 2 months in winter winds blow from the northwest. Thunderstorms occur on about 46 days each year, mostly in spring and early in summer. These storms seldom damage crops or property.

4/ By L. A. SCHAAL, State climatologist, National Weather Service.

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TABLE 11.--TEMPERATURE AND PRECIPITATION, HOWARD COUNTY, INDIANA

Month	Temperature					Heating degree days 1/	Precipitation			Average number of days with--				
	Average daily maximum	Average daily minimum	Average monthly	Record high	Record low		Average monthly	Greatest daily	Average monthly snowfall	0.10 inch or more precipitation	Maximum temperature of--		Minimum temperature of--	
											90° and above	32° and below	32° and below	0° and below
	°F.	°F.	°F.	°F.	°F.		Inches	Inches	Inches					
Jan.	36.5	20.7	28.6	72	-22	1,104	2.52	2.12	5.8	4	0	11	28	3
Feb.	39.8	22.4	31.1	72	-15	935	2.22	2.57	5.2	4	0	7	24	2
Mar.	49.9	30.4	40.2	83	-10	784	2.97	2.66	3.8	6	0	2	19	(3/)
Apr.	63.4	40.6	52.0	94	17	396	3.98	2.98	0.5	7	(3/)	(3/)	6	0
May.	74.8	51.3	63.1	100	27	146	4.14	4.95	(2/)	8	2	0	(3/)	0
June	85.4	61.1	73.3	107	37	15	4.02	4.72	0	7	11	0	0	0
July	89.3	64.7	77.0	110	47	0	3.62	4.96	0	7	14	0	0	0
Aug.	87.1	62.8	75.0	106	40	0	3.02	3.00	0	5	11	0	0	0
Sept.	80.3	55.5	67.9	103	30	69	3.06	6.75	(2/)	4	5	0	(3/)	0
Oct.	68.2	45.1	56.7	91	21	285	2.73	2.55	(2/)	4	(3/)	0	3	0
Nov.	50.6	33.1	41.9	81	-5	690	2.84	2.70	2.2	5	0	2	15	(3/)
Dec.	38.4	23.3	30.9	68	-12	1,035	2.06	1.47	6.2	4	0	10	26	2
Year	63.6	42.6	53.1	110	-22	5,459	37.18	6.75	23.7	65	43	32	121	7

1/ Base 65° F.

2/ Traces too small to measure.

3/ Less than one-half day.

TABLE 12.--CHANCE OF LAST CRITICAL TEMPERATURES IN SPRING AND FIRST IN FALL

Temperature	Chance of occurrence after date in spring--					Chance of occurrence before date in fall--				
	90 percent	75 percent	50 percent	25 percent	10 percent	10 percent	25 percent	50 percent	75 percent	90 percent
°F.										
40----------	May 6	May 13	May 20	May 27	June 3	Sept. 13	Sept. 19	Sept. 26	Oct. 3	Oct. 9
36----------	Apr. 26	May 2	May 8	May 14	May 20	Sept. 25	Oct. 2	Oct. 9	Oct. 16	Oct. 23
32----------	Apr. 10	Apr. 17	Apr. 24	May 1	May 8	Oct. 6	Oct. 14	Oct. 22	Oct. 30	Nov. 7
28----------	Mar. 21	Mar. 29	Apr. 7	Apr. 16	Apr. 24	Oct. 21	Oct. 28	Nov. 4	Nov. 11	Nov. 18
24----------	Mar. 8	Mar. 17	Mar. 27	Apr. 6	Apr. 15	Oct. 27	Nov. 4	Nov. 13	Nov. 22	Nov. 30
20----------	Feb. 27	Mar. 7	Mar. 16	Mar. 25	Apr. 2	Nov. 6	Nov. 14	Nov. 23	Dec. 2	Dec. 10
16----------	Feb. 14	Feb. 23	Mar. 6	Mar. 17	Mar. 26	Nov. 15	Nov. 26	Dec. 7	Dec. 18	Dec. 29

Settlement, Agriculture, and Industry

The area of Howard County was purchased by the Federal government from the Miami Indians. The county was organized in January 1844 and named Richardville County. In December 1846, the State Legislature changed the name to Howard County. Honey Creek township was ceded by Clinton County to Howard County in 1858.

Early settlements in the county were along the major creeks. The creeks were used by traders and farmers to float goods to market on rafts. Farmers first settled in the well-drained rolling areas and began clearing the forests to plant crops. Most areas of the county are nearly level and consisted originally of swamps that were settled more slowly. These swampy areas had to be cleared of dense forests and undergrowth and then drained before the soils could be used for crops.

Approximately 53 percent of farm income in the county is derived from the sale of livestock or livestock products. A large amount of the corn grown locally is used for hogs and feeder cattle. Hogs account for about 35 percent of farm income, and beef cattle for about 15 percent. Other livestock, such as dairy cows, sheep, and poultry, accounts for only about 3 percent.

Approximately 47 percent of farm income is derived from the sale of grain and vegetable crops. Soybeans account for about 16 percent, corn for 14 percent, wheat and oats for 8 percent, and tomatoes for 6 percent. Other crops make up about 3 percent of farm income. The acreage of crops varies from year to year, but it generally is 67,000 acres of corn, 37,000 acres of soybeans, 10,000 acres of wheat, and 4,600 acres of oats.

Industry in the county developed very slowly at first, but the discovery of natural gas in 1886 transformed Kokomo from an agricultural center into a booming manufacturing city. Many factories were built to utilize the cheap natural gas, and a few still use it. At present 75 industries in Kokomo manufacture automobile parts, electronic equipment, steel and steel products, alloys and chemicals, plastics, glass, tableware, playground equipment, and many other products.

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ABC soil. A soil that has a complete profile, including an A, B, and C horizon.

AC soil. A soil that has an A and a C horizon but no B horizon. Commonly such soils are immature, as those developing from alluvium or those on steep, rocky slopes.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are--

Loose.--Noncoherent when dry or moist; does not hold together in a mass.

Friable.--When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.--When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.--When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.--When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.--When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.--When dry, breaks into powder or individual grains under very slight pressure.

Cemented.--Hard and brittle; little affected by moistening.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.--The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.--The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.--The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused by (1) accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.--The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.--Consolidated rock beneath the soil. The rock usually underlies a C horizon

but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance--few, common, and many; size--fine, medium, and coarse; and contrast--faint, distinct, and prominent. The size measurements are these: fine, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; medium, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and coarse, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables--hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Natural soil drainage. Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and in Podzolic soils commonly have mottlings below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill normally is a few inches in depth and width and is not large enough to be an obstacle to farm machinery.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be any mineral composition. The textural class name of any soil that contains 85 percent

or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: Very coarse sand (2.0 to 1.0 millimeter); coarse sand (1.0 to 0.5 millimeter); medium sand (0.5 to 0.25 millimeter); fine sand (0.25 to 0.10 millimeter); very fine sand (0.10 to 0.05 millimeter); silt (0.05 to 0.002 millimeter); and clay (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are--platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are (1) single grain (each grain by itself, as in dune sand) or (2) massive (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

U. S. GOVERNMENT PRINTING OFFICE : 1971) - 413-808

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. Facts about woodland are given on page 31 and in table 3, page 31, and table 4, page 34. For information about wildlife, see page 36 and table 5, page 37. Other information is given in tables as follows:

Acreage and extent, table 1, page 6.
Estimated yields, table 2, page 39.

Engineering uses of the soils, tables 6, 7, 8, and 9, pages 40 through 55.

Map symbol	Mapping unit	Described on page	Capability unit		Tree and shrub group	Wildlife group
			Symbol	Page	Number	Number
BmA	Blount silt loam, 0 to 2 percent slopes	8	IIw-2	26	3	1
BmB2	Blount silt loam, 2 to 4 percent slopes, eroded	8	IIe-12	26	3	1
Bs	Brookston silty clay loam	9	IIw-1	26	2	1
Ca	Carlisle muck	9	IIIw-8	28	1	6
CsA	Crosby silt loam, 0 to 2 percent slopes	10	IIw-2	26	3	1
CsB2	Crosby silt loam, 2 to 4 percent slopes, eroded	11	IIe-12	26	3	1
CyB2	Crosby-Miami silt loams, 2 to 6 percent slopes, eroded	11	IIe-12	26	3	1
Fc	Fincastle silt loam	12	IIw-2	26	3	1
FoA	Fox silt loam, 0 to 2 percent slopes	13	IIs-1	27	4	3
FoB2	Fox silt loam, 2 to 6 percent slopes, eroded	13	IIe-9	26	4	3
FsC3	Fox soils, 6 to 12 percent slopes, severely eroded	13	IVe-9	28	4	3
Gh	Genesee silt loam	14	I-2	25	4	2
Gp	Gravel pits	14	VIIIs-2	29	---	---
HeE	Hennepin loam, 25 to 60 percent slopes	14	VIIe-2	29	5	4
Kk	Kokomo silty clay loam	15	IIw-1	26	2	1
Ko	Kokomo silt loam, overwash	15	IIw-1	26	2	1
Lw	Linwood muck	16	IIw-10	27	1	6
Ma	Made land	16	VIIIs-2	29	---	---
MlB2	Miami silt loam, 2 to 6 percent slopes, eroded	16	IIe-1	25	4	5
MlC2	Miami silt loam, 6 to 12 percent slopes, eroded	17	IIIe-1	27	4	5
MmB3	Miami clay loam, 2 to 6 percent slopes, severely eroded	17	IIIe-1	27	4	5
MmC3	Miami clay loam, 6 to 12 percent slopes, severely eroded	17	IVe-1	28	4	5
MmD3	Miami clay loam, 12 to 18 percent slopes, severely eroded	17	VIe-1	29	4	5
MrB2	Morley silt loam, 2 to 6 percent slopes, eroded	18	IIe-6	26	4	5
MsB3	Morley silty clay loam, 2 to 6 percent slopes, severely eroded	18	IIIe-6	28	4	5
MsC3	Morley silty clay loam, 6 to 12 percent slopes, severely eroded	18	IVe-6	28	4	5
OcA	Ockley silt loam, 0 to 2 percent slopes	19	I-1	25	4	3
OcB2	Ockley silt loam, 2 to 6 percent slopes, eroded	19	IIe-3	25	4	3
OkA	Ockley silt loam, loamy substratum, 0 to 2 percent slopes	19	I-1	25	4	3
OkB2	Ockley silt loam, loamy substratum, 2 to 6 percent slopes, eroded	20	IIe-3	25	4	3
Pa	Patton silty clay loam, loamy substratum	20	IIw-1	26	2	1
Pc	Patton silty clay loam, occasionally flooded	21	IIw-1	26	2	1
Pe	Pewamo silty clay loam	21	IIw-1	26	2	1
Qu	Quarries	22	VIIIs-2	29	---	---
RuA	Russell silt loam, 0 to 2 percent slopes	22	I-1	25	4	5
RuB2	Russell silt loam, 2 to 6 percent slopes, eroded	22	IIe-3	25	4	5
Sh	Shoals silt loam	23	IIw-7	27	3	2

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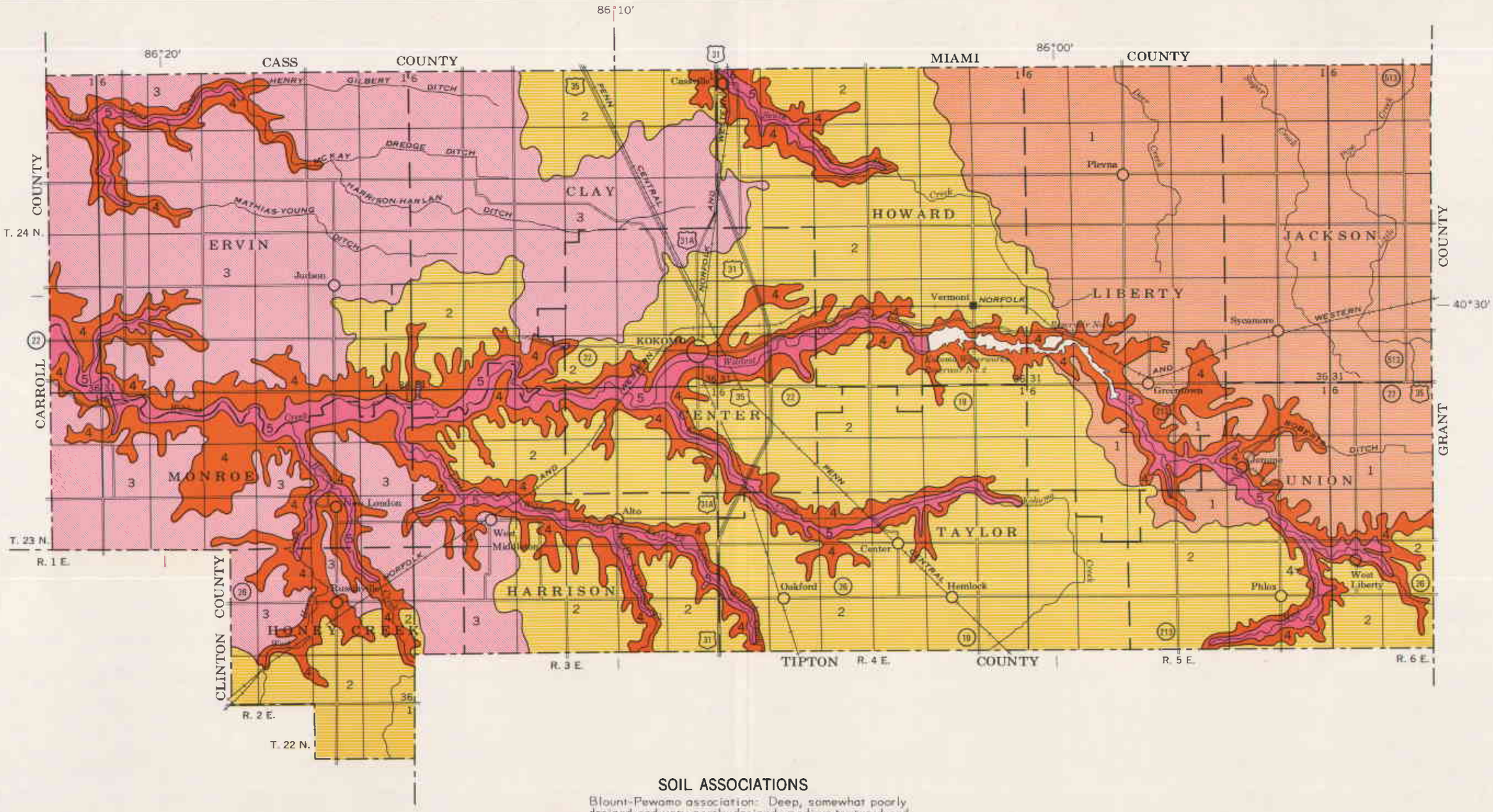


SOIL ASSOCIATIONS

1. Blount-Pewamo association: Deep, somewhat poorly drained and very poorly drained, medium-textured and moderately fine textured, nearly level to gently sloping soils that have a fine-textured layer in the subsoil; on uplands
2. Crosby-Brookston association: Deep, somewhat poorly drained and very poorly drained, medium-textured and moderately fine textured, nearly level and gently sloping soils; on uplands
3. Fincastle-Brookston association: Deep, somewhat poorly drained and very poorly drained, medium-textured and moderately fine textured, nearly level soils; on uplands
4. Miami-Russell-Morley association: Deep, well-drained, medium-textured and moderately fine textured, gently sloping to strongly sloping soils; on uplands
5. Genesee-Shoals association: Deep, well-drained and somewhat poorly drained, medium-textured, nearly level soils; on alluvial bottoms

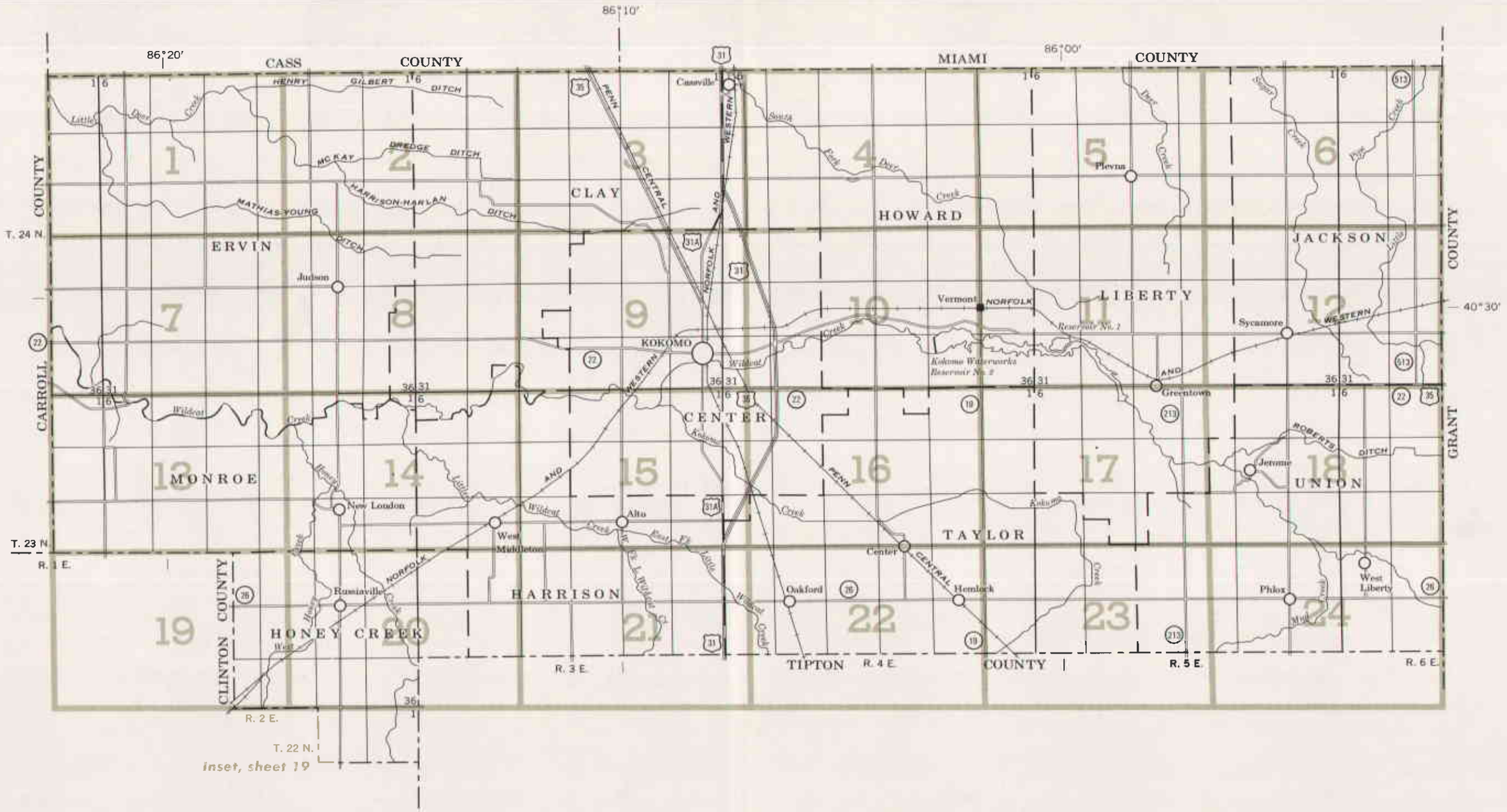
January 1971

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

HOWARD COUNTY, INDIANA

1 0 1 2 3 4 Miles



INDEX TO MAP SHEETS

HOWARD COUNTY, INDIANA

1 0 1 2 3 4 Miles

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

HOWARD COUNTY, INDIANA

PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Tunnel

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches (CANAL)

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Alluvial fan

Drainage end

RELIEF

Escarpments
- Bedrock
- Other

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, or E, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. A final number, 2 or 3, in the symbol, shows that the soil is eroded or severely eroded.

SYMBOL	NAME
BmA	Blount silt loam, 0 to 2 percent slopes
BmB2	Blount silt loam, 2 to 4 percent slopes, eroded
Bs	Brookston silty clay loam
Co	Carlisle muck
CsA	Crosby silt loam, 0 to 2 percent slopes
CsB2	Crosby silt loam, 2 to 4 percent slopes, eroded
CyB2	Crosby-Miami silt loams, 2 to 6 percent slopes, eroded
Fc	Fincastle silt loam
FoA	Fox silt loam, 0 to 2 percent slopes
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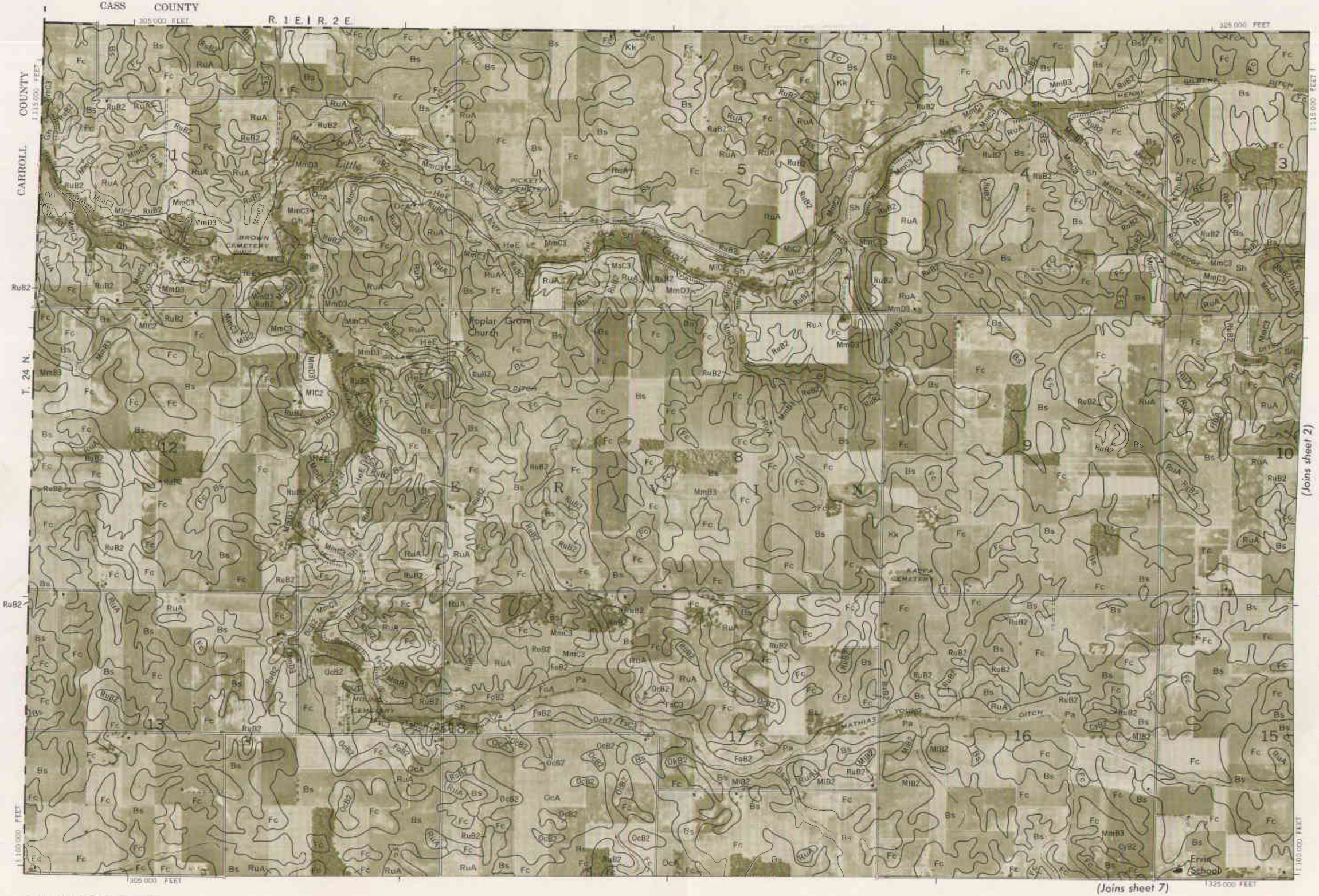
FsC3	Fox soils, 6 to 12 percent slopes, severely eroded
Gh	Genesee silt loam
Gp	Gravel pits
HeE	Hennepin loam, 25 to 60 percent slopes
Kk	Kokomo silty clay loam
Ko	Kokomo silt loam, overwash
Lw	Linwood muck
Ma	Made land
MiB2	Miami silt loam, 2 to 6 percent slopes, eroded
MlC2	Miami silt loam, 6 to 12 percent slopes, eroded
MmB3	Miami clay loam, 2 to 6 percent slopes, severely eroded
MmC3	Miami clay loam, 6 to 12 percent slopes, severely eroded
MmD3	Miami clay loam, 12 to 18 percent slopes, severely eroded
MrB2	Morley silt loam, 2 to 6 percent slopes, eroded
MsB3	Morley silty clay loam, 2 to 6 percent slopes, severely eroded
MsC3	Morley silty clay loam, 6 to 12 percent slopes, severely eroded
OcA	Ockley silt loam, 0 to 2 percent slopes
OcB2	Ockley silt loam, 2 to 6 percent slopes, eroded
OkA	Ockley silt loam, loamy substratum, 0 to 2 percent slopes
OkB2	Ockley silt loam, loamy substratum, 2 to 6 percent slopes, eroded
Pa	Patton silty clay loam, loamy substratum
Pc	Patton silty clay loam, occasionally flooded
Pe	Pewamo silty clay loam
Qu	Quarries
RuA	Russell silt loam, 0 to 2 percent slopes
RuB2	Russell silt loam, 2 to 6 percent slopes, eroded
Sh	Shoals silt loam

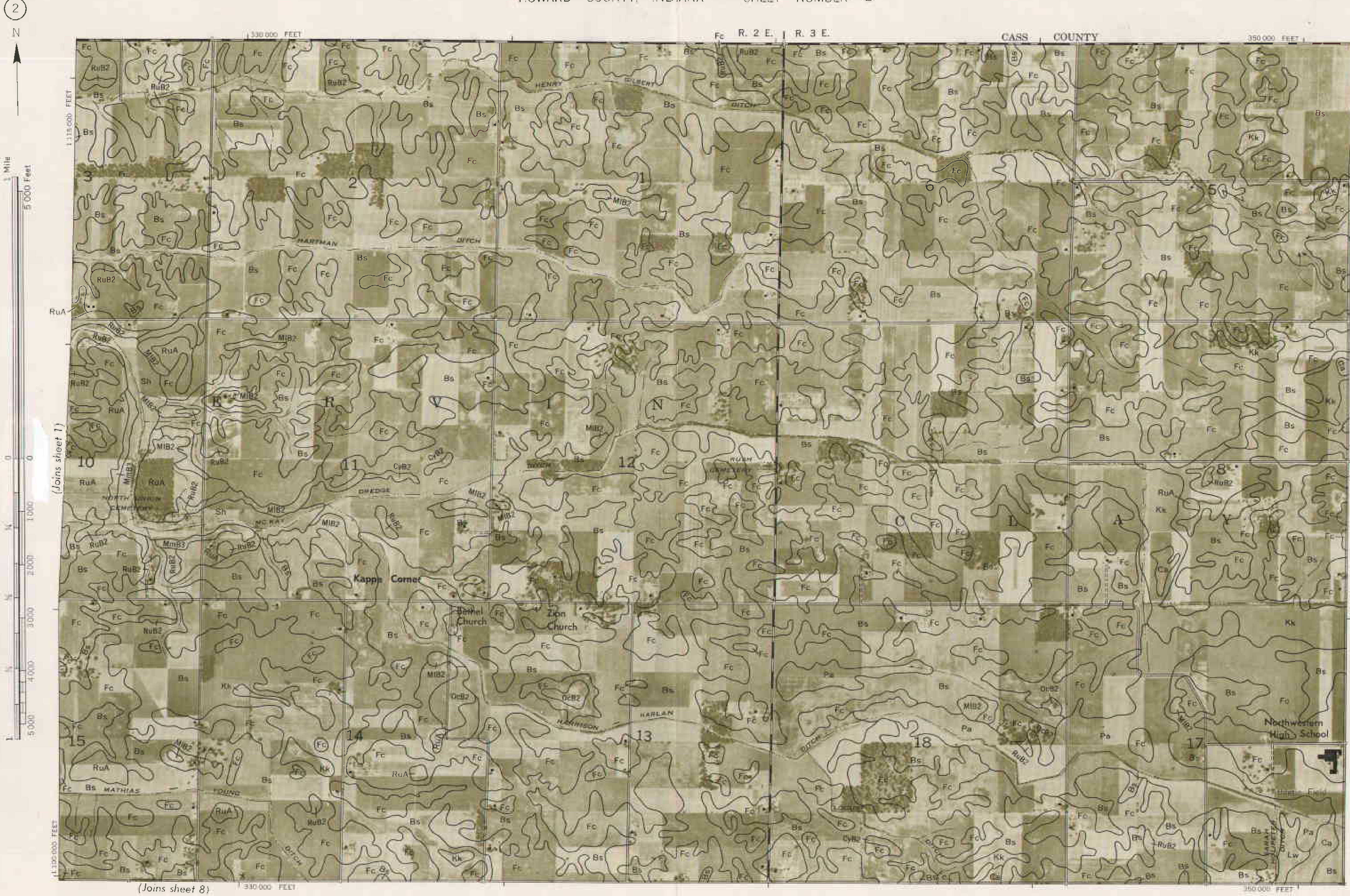
HOWARD COUNTY, INDIANA — SHEET NUMBER 1



HOWARD COUNTY, INDIANA NO. 1

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Purdue University Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

Photo base from 1964 aerial photographs.
5 000-foot grid ticks based on Indiana plane coordinate system, east zone, 1927 North American datum.



HOWARD COUNTY, INDIANA NO. 2

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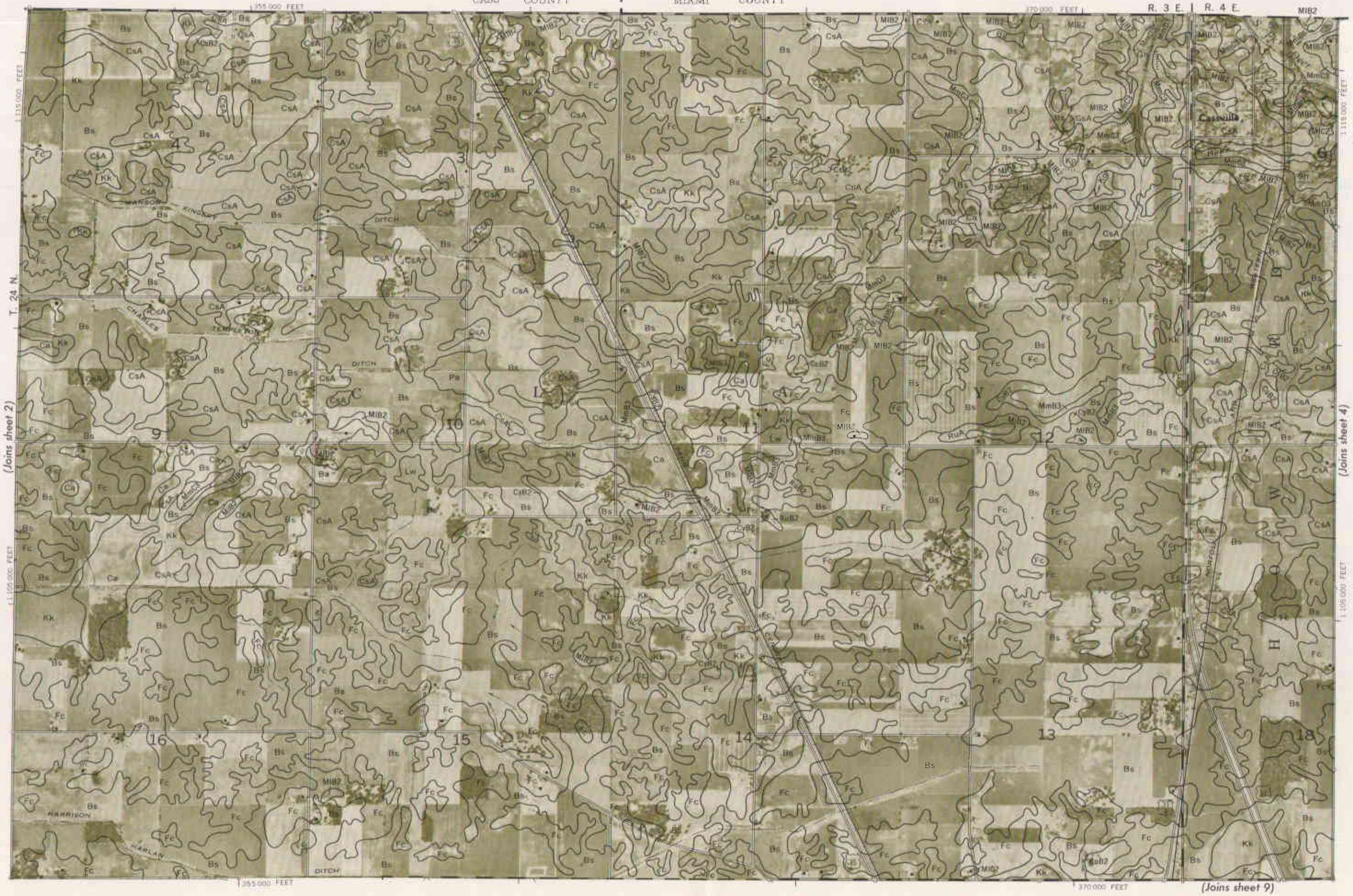
HOWARD COUNTY, INDIANA — SHEET NUMBER 3



HOWARD COUNTY, INDIANA NO. 3

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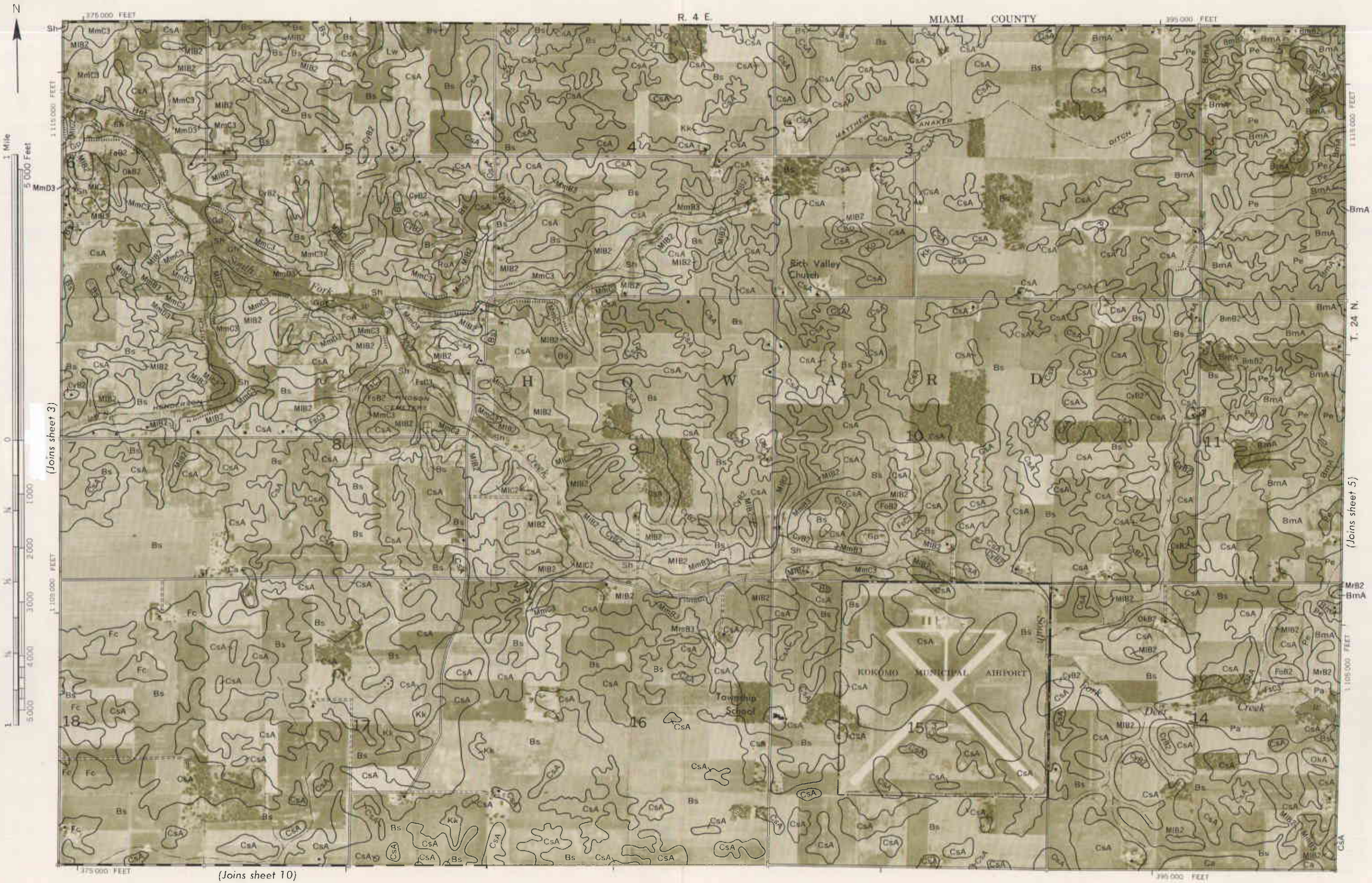
N
375,000 FEET
R. 4 E.
MIAMI COUNTY
395,000 FEET
1,115,000 FEET
1 Mile
5,000 Feet
0
1000
2000
3000
4000
5000
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 10)
T. 24 N.
Sith Valley Church
KOKOMO MUNICIPAL AIRPORT
Township School
Wildcat Creek
Deer Creek
Fork
HATTHEW
ANAKER
DITCH
HOWARD COUNTY, INDIANA NO. 4
Land division corners are approximately positioned on this map.
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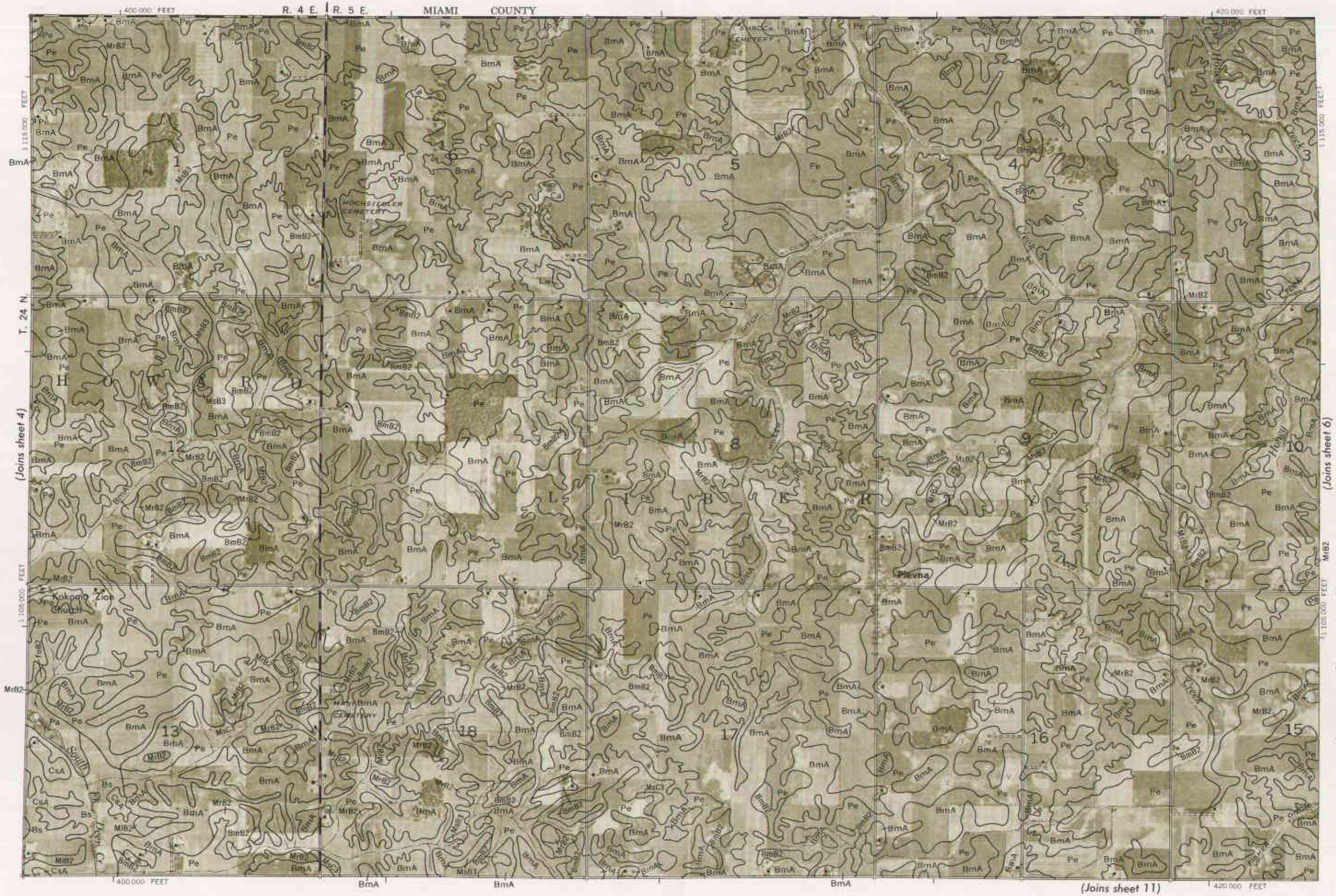
Land division corners are approximately positioned on this map.
HOWARD COUNTY, INDIANA NO. 5



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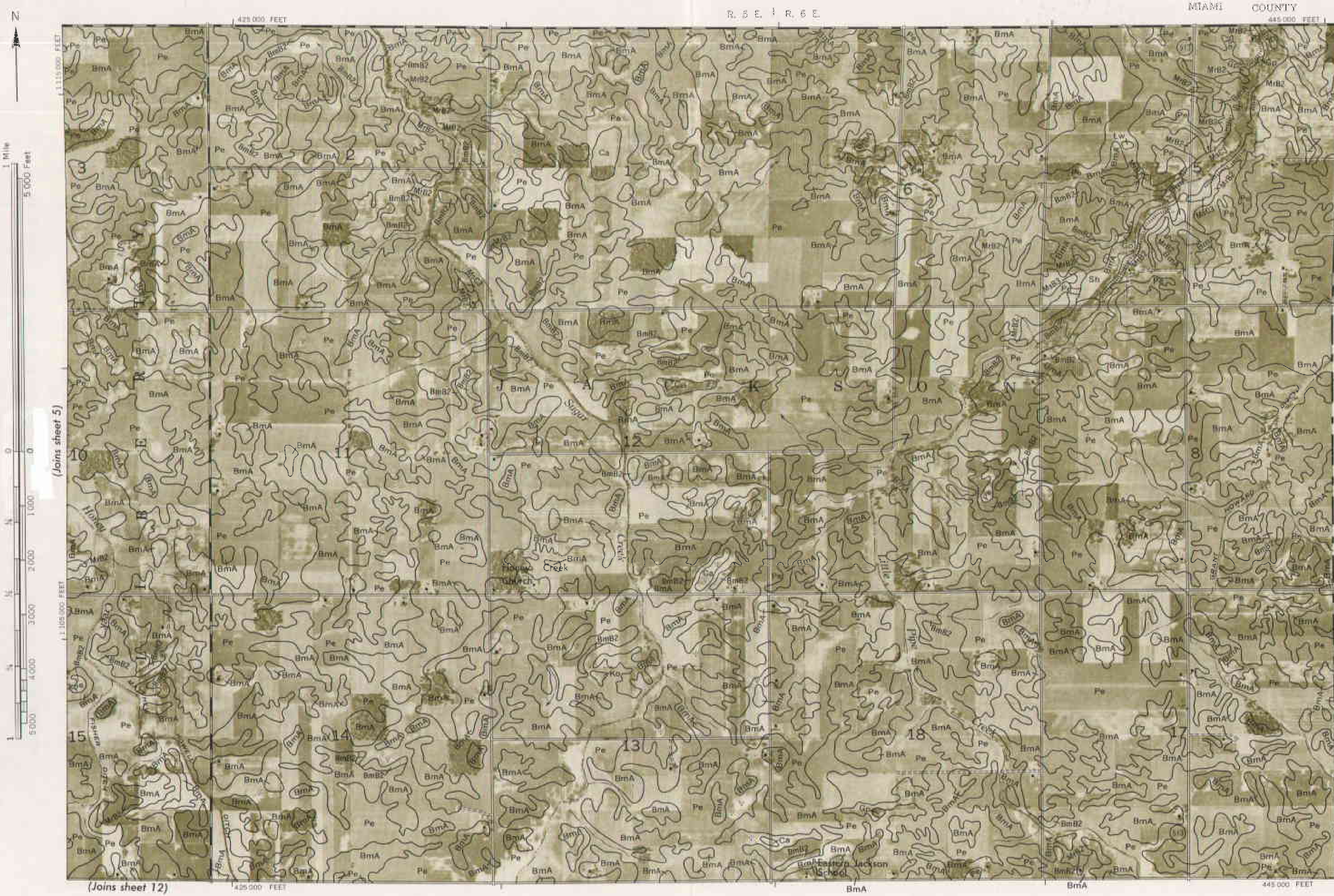
HOWARD COUNTY, INDIANA — SHEET NUMBER 6



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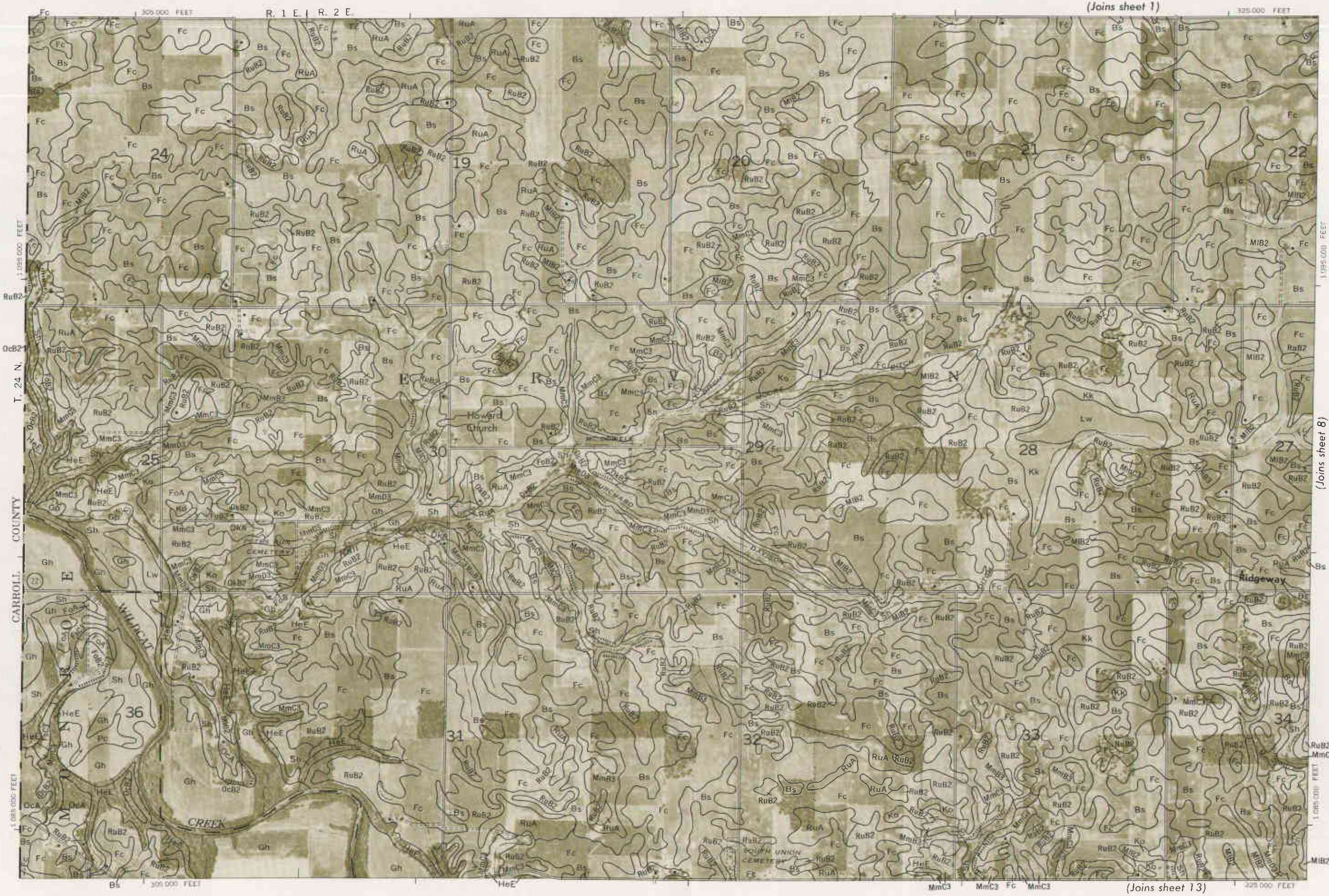

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HOWARD COUNTY, INDIANA NO. 7

Land division corners are approximately positioned on this map.

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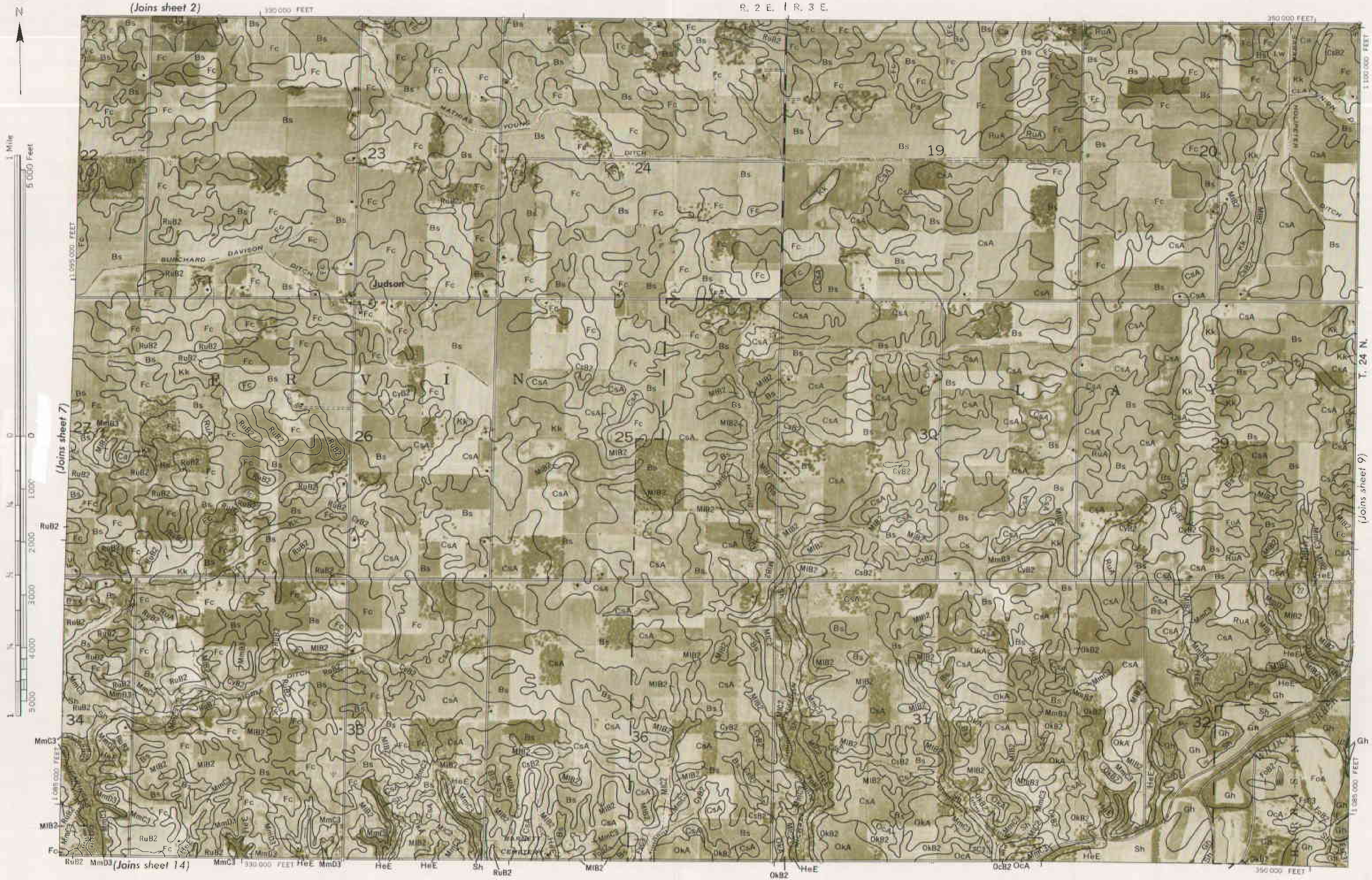
HOWARD COUNTY, INDIANA — SHEET NUMBER 8



HOWARD COUNTY, INDIANA NO. 8

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HOWARD COUNTY, INDIANA NO. 9

9

N

R. 3 E. | R. 4 E. (Joins sheet 3)

T. 24 N.

T 24 N
R 3 E
R 4 E

HARRISON — HARLAN DITCH

KOKOMO

CROWN POINT CEMETERY

CREEK

WILDCAT

NORFOLK AND WESTERN

CENTRAL

(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 15)

1 100 000 FEET

1 095 000 FEET

365 000 FEET

370 000 FEET

1 Mile

5 000 Feet

0 1000 2000 3000 4000 5000

Photo base from 1964 aerial photographs.
5 000-foot grid ticks based on Indiana plane coordinate system, east zone, 1927 North American datum.

N

1 Mile

5,000 Feet

0 ½ 1 1,000 2,000 3,000 4,000 5,000

(Joins sheet 9)

375,000 FEET

(Joins sheet 4)

R. 4 E.

395,000 FEET

1,100,000 FEET

T. 24 N.

(Joins sheet 11)

1,085,000 FEET

(Joins sheet 16)

KOKOMO

Darrough Chapel

Vermont

WILDCAT CREEK

KOKOMO WATERWORKS RESERVOIR NO 2

HOWARD COUNTY, INDIANA NO. 10

Land division corners are approximately positioned on this map.

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Land division corners are approximately positioned on this map.

HOWARD COUNTY, INDIANA NO. 11

R. 4 E. | R. 5 E.

T. 24 N.

(Joins sheet 5)

(Joins sheet 10)

(Joins sheet 12)

(Joins sheet 17)

400 000 FEET

420 000 FEET

1 085 000 FEET

H O W A R D

WILDCAT CREEK

KOKOMO

WATERWORKS

RESERVOIR NO. 1

RESERVOIR NO. 2

GREENLAWN CEMETERY

GREENTOWN

Photo base from 1964 aerial photographs
5 000-foot grid ticks based on Indiana plane coordinate system, east zone, 1927 North American datum.

1 Mile

5 000 Feet

HOWARD COUNTY, INDIANA NO. 12

Land division corners are approximately positioned on this map.

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Land division corners are approximately positioned on this map.

HOWARD COUNTY, INDIANA NO. 13

R. 1 E. | R. 2 E.

T. 23 N.

(Joins sheet 7)

(Joins sheet 14)

(Joins sheet 19)

HOWARD COUNTY

CARROLL COUNTY

CLINTON COUNTY

Oakland Church

Shanghai

Cloverdale Church

New Zion Church

Wildcat Creek

Little Wildcat Creek

Walnut Fork

1 Mile

5 000 Feet

N

Photo base from 1964 aerial photographs.
5 000-foot grid ticks based on Indiana plane coordinate system, east zone, 1927 North American datum.

HOWARD COUNTY, INDIANA — SHEET NUMBER 14

HOWARD COUNTY, INDIANA NO. 14

Land division corners are approximately positioned on this map.

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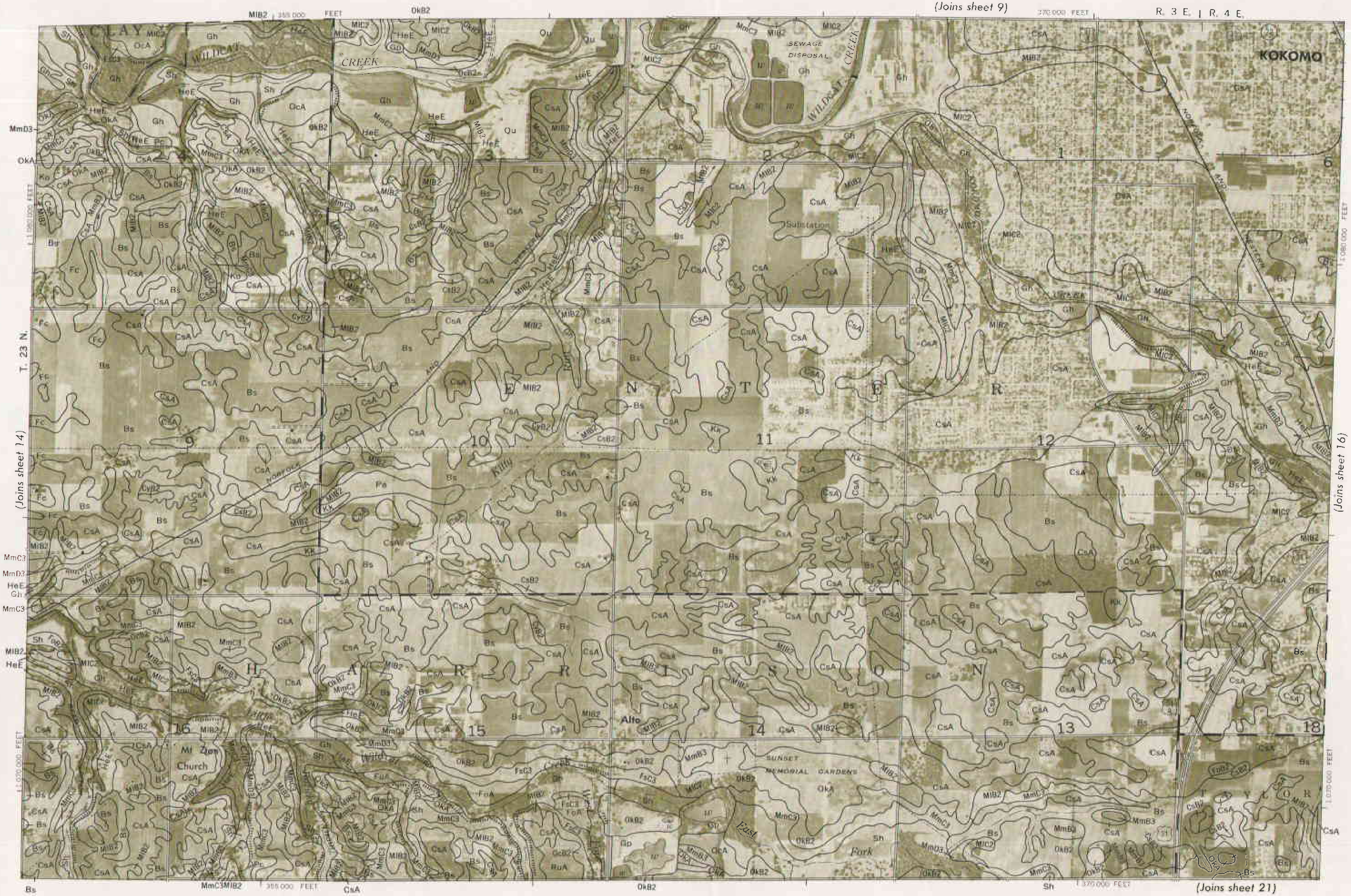
Photo base from 1964 aerial photographs.
5 000-foot grid ticks based on Indiana plane coordinate system, east zone, 1927 North American datum.



1 Mile
5 000 Feet
0 1000 2000 3000 4000 5000

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Purdue University Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

HOWARD COUNTY, INDIANA NO. 15

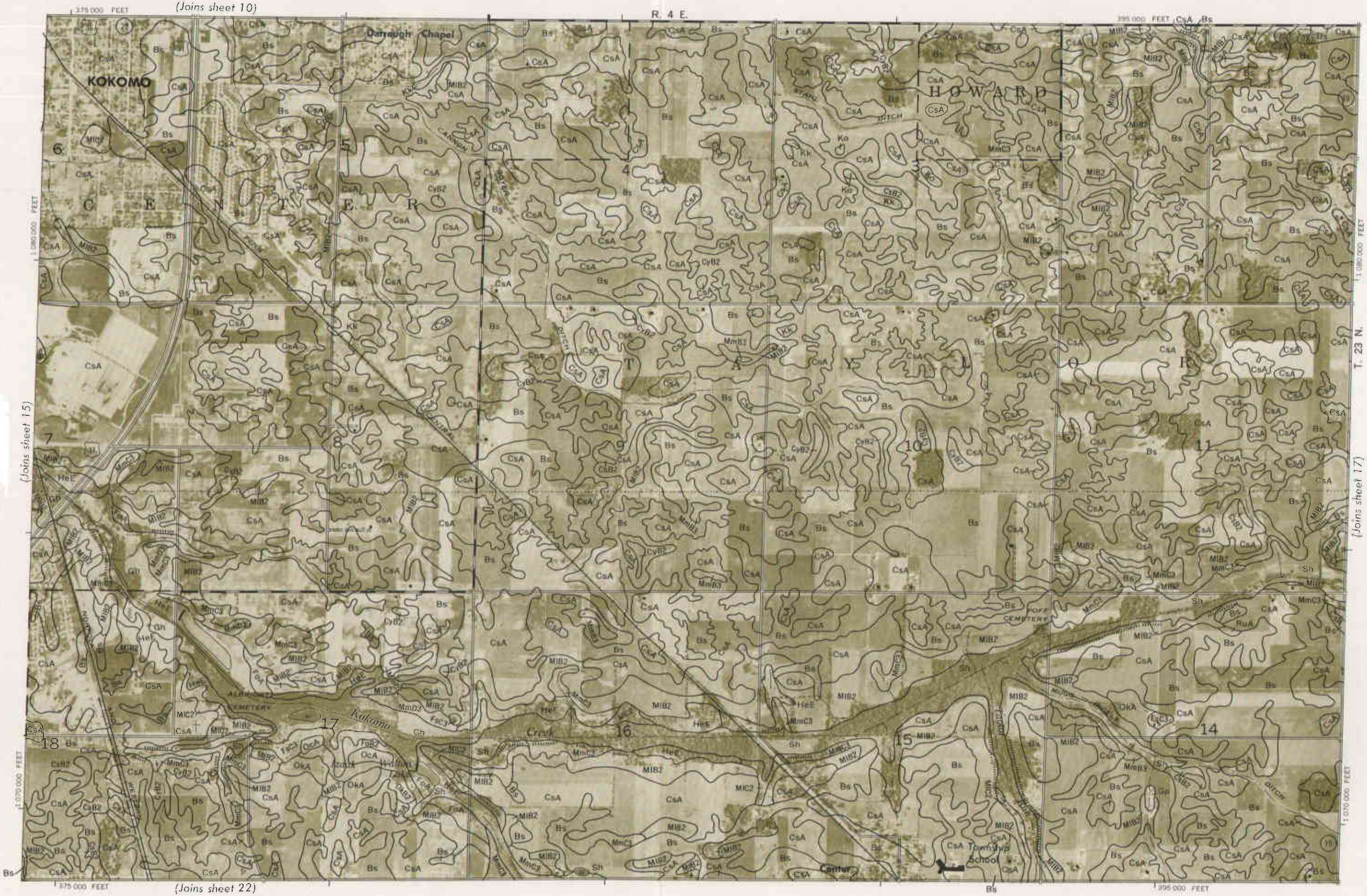
Photo base from 1964 aerial photographs.
5 000-foot grid ticks based on Indiana plane coordinate system, east zone, 1927 North American datum.

16

N

1 Mile

5,000 Feet



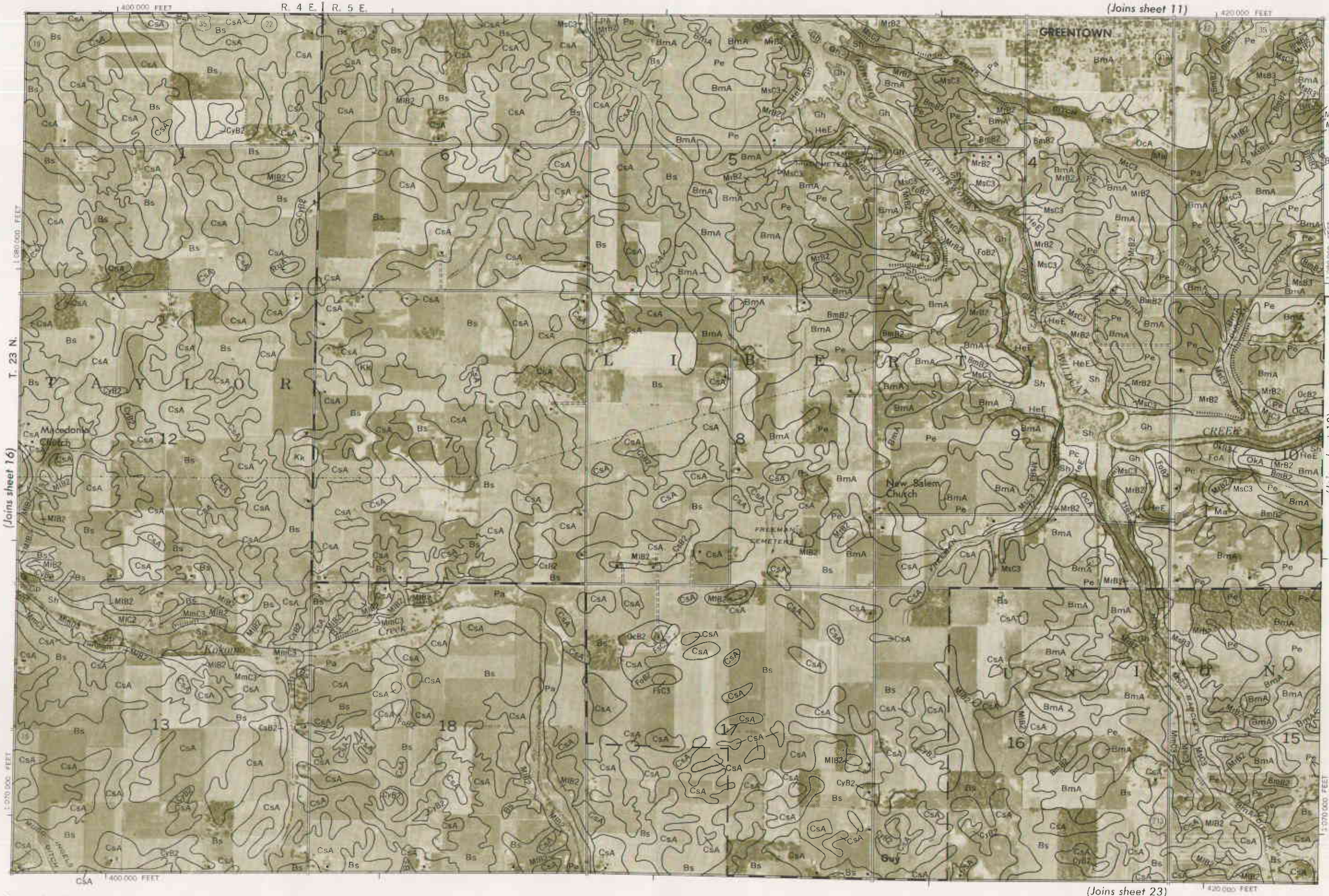
HOWARD COUNTY, INDIANA NO. 16

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Purdue University Agricultural Experiment Station.

Photo base from 1964 aerial photographs.
5 000-foot grid ticks based on Indiana plane coordinate system, east zone. 1927 North American datum.

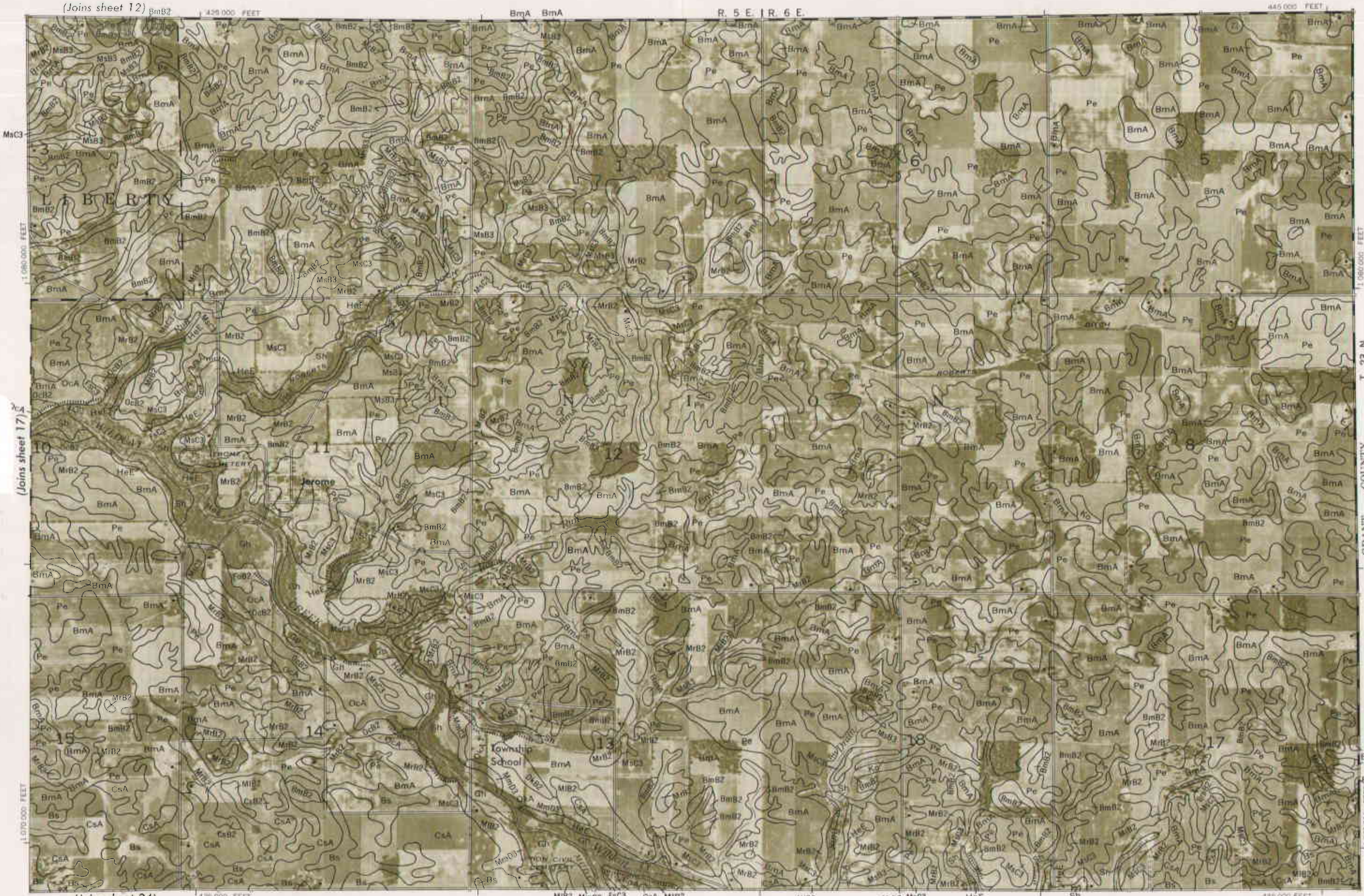
HOWARD COUNTY, INDIANA — SHEET NUMBER 17



This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Purdue University Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

HOWARD COUNTY, (NDIANA NO. 17

Photo base from 1964 aerial photographs.
5 000-foot grid ticks based on Indiana plane coordinate system, east zone, 1927 North American datum.



HOWARD COUNTY, INDIANA NO. 18

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Purdue University Agricultural Experiment Station.

Photo base from 1964 aerial photographs.
5 000-foot grid ticks based on Indiana plane coordinate system, east zone, 1927 North American datum.

HOWARD COUNTY, INDIANA NO. 19

305 000 FEET

1 065 000 FEET

(Joins sheet 13)

R. 2 E.

325 000 FEET

1 058 000 FEET

(Joins sheet 20)

T. 23 N.

R. 2 E.

330 000 FEET

335 000 FEET

1 052 000 FEET

1 055 000 FEET

1 048 000 FEET

T. 22 N.

CLINTON COUNTY

HONEY CREEK

TIPTON COUNTY

CLINTON COUNTY

CLINTON COUNTY

GRID TICK INTERVAL 2000 FEET ON NORTH-SOUTH LINE

305 000 FEET

325 000 FEET

Photo base from 1964 aerial photographs.
5 000-foot grid ticks based on Indiana plane coordinate system, east zone, 1927 North American datum.

N

1 Mile

5 000 Feet

N

1 Mile

5 000 Feet

0 0

1 000 2 000 3 000 4 000 5 000

R. 3 E. | R. 3 E.

330 000 FEET

1 065 000 FEET

T. 23 N.

RUSSIAVILLE

HOWARD COUNTY

TIPTON COUNTY

CLINTON CO

(Joins sheet 14)

(Joins sheet 19)

(Joins sheet 21)

(Joins inset, sheet 19)

Photo base from 1964 aerial photographs.
5 000-foot grid ticks based on Indiana plane coordinate system, east zone, 1927 North American datum.

HOWARD COUNTY, INDIANA NO. 20

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Purdue University Agricultural Experiment Station.

(Joins sheet 15)

(Joins sheet 20)

(Joins sheet 22)

21

N

R. 3 E. | R. 4 E.

T. 23 N.

Indian Heights

Trinity Temple

HARRISON

TIPTON COUNTY

355 000 FEET

360 000 FEET

370 000 FEET

1 065 000 FEET

1 060 000 FEET

1 Mile

5 000 Feet

Photo base from 1964 aerial photographs.
5 000-foot grid ticks based on Indiana plane coordinate system, east zone, 1927 North American datum.

This soil survey was compiled in 1976 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Purdue University Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

HOWARD COUNTY, INDIANA NO. 21

22

N

1 Mile
5 000 Feet

375 000 FEET

(Joins sheet 16)

R. 4 E.

395 000 FEET

1 065 000 FEET

T. 23 N.

(Joins sheet 21)

(Joins sheet 23)

Indian Heights

Oakford

Center

Hemlock

TIPTON COUNTY

1 055 000 FEET

375 000 FEET

395 000 FEET

Photo base from 1954 aerial photographs.
5 000-foot grid ticks based on Indiana plane coordinate system, east zone, 1927 North American datum.

HOWARD COUNTY, INDIANA NO. 22

Land division corners are approximately positioned on this map.

This survey of a set complies in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Purdue University Agricultural Experiment Station.

(23)

Photo base from 1964 aerial photographs.
5 000-foot grid ticks based on Indiana plane coordinate system, east zone, 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Purdue University Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

HOWARD COUNTY, INDIANA NO. 23

(24)

N

(Joins sheet 18)

R. 5 E. | R. 6 E.

425 000 FEET

445 000 FEET

1 055 000 FEET

T. 23 N.

West Liberty

Phlox

Center Grove Church

Howard Chapel

NEW HOPE CEMETERY

CREEK

GRANT COUNTY

TIPTON COUNTY

(Joins sheet 23)

1 Mile

5 000 Feet

0 1000 2000 3000 4000 5000

Photo base from 1964 aerial photographs.
5 000-foot grid ticks based on Indiana plane
coordinate system, east zone, 1927 North American datum.

HOWARD COUNTY, INDIANA NO. 24

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture Soil Conservation Service, and the Purdue University Agricultural Experiment Station